J. Mitford. 1817. (Nov. 1840.)

For some Anecdotes, and account of "Mead", see Miss Hawkins's Anecdotes. p. 149.

See Poem called 'Scandalizade'. p. 126 on Mead.

see Trist. Shandy. Dr Kunastrokius. p. 23.

See Warburton's Works. vol. VI. p. 392. vol. X. p. 150.
Walpole's Misc: letters. vol. II. p. 343.

'The Latin style of Meads works, Parr said, is entitled to commendation; but he added, tho' a good scholar, Mead was not skilful in writing Latin; and was therefore obliged to borrow the aid of Dr Ward, and Dr Leatherland'.

v. Physic and Physicians. I. p. 31.

See Seward's Biographiana. ii. p. 571. for one letter of Warburton on Dr Mead. also Dr. Heberden's praise of him.

~~7321.d.14~~

1508/1689

THE

MEDICAL WORKS

OF

RICHARD MEAD, M. D.

Phyſician to his late Majeſty K. GEORGE II.

Fellow of the ROYAL COLLEGES of PHYSICIANS
at LONDON and EDINBURGH, and of
the ROYAL SOCIETY.

IN THREE VOLUMES.

EDINBURGH:
Printed by A. DONALDSON and J. REID.
For ALEX. DONALDSON.
MDCCLXIII.

BRITISH MUSEUM

THE

MEDICAL WORKS

OF

Dr RICHARD MEAD. K,

VOLUME I.

CONTAINING

A Mechanical Account of Poisons; and,
A Treatise concerning the Influence of the
Sun and Moon upon Human Bodies, and
the Diseases thereby occaſioned.

EDINBURGH:
Printed by A. Donaldson and J. Reid.
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MEMOIRS of the LIFE and WRITINGS of the AUTHOR.

DR RICHARD MEAD was deſcended from a conſiderable family in Buckinghamſhire, and born at Stepney, a ſmall village near London, in Auguſt 1673. His father, Mr Matthew Mead, was a celebrated divine among the nonconformiſts, and had been one of the two miniſters of that pariſh; but was ejected in 1662. He had a very numerous family; yet, having a handſome fortune, he educated his children liberally, and kept a private tutor in his houſe for that purpoſe.

Party-rage running high at the end of Charles II.'s reign, Mr Mead became obnoxious, and was forced to withdraw himſelf. He went into Holland, after having placed his ſon Richard at a ſchool, under Mr Singleton, an able maſter of his own principles. Here he made a great progreſs in every thing which belonged to the belles lettres; and, in the year 1689, was ſent to Utrecht, to complete thoſe ſtudies under the illuſtrious Grævius, to whom he was recommended by his eldeſt brother, who had alſo been his pupil.

After three years reſidence at Utrecht, he went to Leyden; and being determined to dedicate himſelf to the ſtudy of phyſic, he attended Herman's botanical courſes, and the famous Pitcairn's lectures on the theory and practice of phyſic. Pitcairn was very reſerved out of college; nevertheleſs, our young ſtudent inſinuated himſelf ſo far into the good graces of this profeſſor, that he drew from him ſeveral obſervations,

vations, of which he afterwards made good uſe in his writings, but never without acknowledging to whom he was indebted for them.

His academical ſtudies being finiſhed, he ſet out upon his travels to Italy, in company with his eldeſt brother Mr Samuel Mead, David Polhill, Eſq; and Dr Thomas Pellet, afterwards preſident of the college of phyſicians at London. In Italy he met with every thing which could gratify and improve his exact and refined taſte, for all that is great and beautiful: and how advantageouſly to himſelf, as well as uſefully to the public, he employed himſelf there, his works bear ample teſtimony.

At Florence he had the curioſity to inquire for the *Tabula Iſiaca*: but getting no information about it, he deſired leave to ſearch for it in a lumber room over the gallery, where he found this valuable piece of antiquity, buried in duſt and rubbiſh. He did the ſame ſervice to the Florentines upon this occaſion, as Tully formerly did the Syracuſians, when he diſcovered to them the tomb of Archimedes *. At Padua he took the degree of Doctor of Philoſophy and Phyſic, in Auguſt 1695; and ſpent ſome time afterwards at Naples and Rome. On his return home in 1696, he ſettled in the place of his birth; where he practiſed phyſic for ſome years, with a ſucceſs and ſuperiority of ſkill, which eſtabliſhed his reputation, and laid the foundation of his future greatneſs.

In 1702, he publiſhed *A Mechanical Account of Poiſons*, which work was ſo well received, that an abſtract of it was inſerted in the Philoſophical Tranſactions † for January and February 1703. It was reprinted in 1708, with ſome additions; but as it ſtands in this collection, it is taken from the edition of 1747, which differed ſo much from any of the former, that it might almoſt be looked upon as a new performance. In his younger days he imagined, that he was able to account mechanically for the effects of ſeveral poiſons, by their mixture with the blood; but he was afterwards convinced, that there is in all living creatures a vehicle infinitely more ſubtile, an ethereal and inviſible liquor, over which poiſons have a real, though inexplicable power *. This retracting of an opinion, early eſpouſed, and which procured him great credit in the literary world, ſhews a candour and ingenuity becoming a great man.

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* Tuſc. Quæſt. v. 3.

† N° 283.

In 1704, appeared his treatiſe *De imperio ſolis ac lunæ in corpora humana, et morbis inde oriundis.* His reaſonings upon this abſtruſe ſubject are grounded upon the principles of planetary attraction, lately diſcovered by Sir Iſaac Newton; and, as the ſyſtem of that illuſtrious philoſopher was then but little known, ſo it is eaſy to conceive, that our author's performance would be rather admired, than underſtood, by the generality of readers. He republiſhed it in 1748, with alterations and additions.

Dr Mead, in his travels through Italy, met with Bonomo's letter to Redi, ſetting forth his diſcoveries with relation to the cutaneous worms that generate the itch. He preſented an analyſis of it to the Royal Society; which, together with his Account of Poiſons, deſervedly procured him a place in that very uſeful body. This analyſis was inſerted in the Philoſophical Tranſactions † of the firſt months of the year 1703.

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* See the preface. † Artic. 2.

This ſame year he was choſen phyſician to St Thomas's hoſpital; and about the ſame time was appointed, by the ſurgeons company, to read the anatomical lectures in their hall.

In 1707, his Paduan diploma for Doctor of Phyſic was confirmed by the univerſity of Oxford. In 1716, he was admitted fellow of the college of phyſicians; and went through all the offices of that learned body, except the preſidentſhip, which he declined in the year 1744. Though nothing could be greater than our phyſician's merit, yet it might not have been thus univerſally known ſo ſoon, if it had not been for the famous Dr Ratcliffe. Ratcliffe took a particular pleaſure in patroniſing a young man of Mead's excellent and amiable endowments: and in 1714, when the former died, the latter ſucceeded him in his houſe, and in the greater part of his buſineſs. He had quitted Stepney ſome years before this, and had reſided in Crutched, and then in Auſtin Friars, for the ſake of being near St Thomas's hoſpital. The diſtance of his new habitation from thence, for Ratcliffe lived in Bloomſbury-Square, induced him to reſign his place of phyſician; upon which occaſion he received the unanimous thanks of the grand committee for his ſervices, and was preſented with a governor's ſtaff.

Dr Mead was now at the head of his order, as we learn from the teſtimony of writers, who cannot be ſuppoſed to have flattered. The celebrated Dr Jurin addreſſed to him *A diſſertation concerning the force of the heart*, written againſt what the no leſs celebrated Dr James Keill had advanced upon that ſubject: and he begins it in the following remarkable manner.

"Sir, Though I am not ignorant how rude and im-"perfect this diſſertation is, yet I readily venture to "ſubmit it to your penetrating judgment. For how "could I wiſh for a more impartial judge, or how "could I chuſe a more proper umpire, than him, "whoſe remarkable candour and humanity are as well "known to us all, as thoſe excellent talents which "he enjoys, adorned with every kind of learning; and "by whoſe bright genius and fine judgment we ſee "the theory of medicine enlightened and illuſtrated, "and the practice of it ſtrengthened and made eaſy? "Nor is there any one living, of whoſe approbation I "ſhould be more deſirous, or under whoſe autho-"rity this diſcourſe, if it has the good fortune not to "diſpleaſe you, will be more ſafe from the cavils of "ſome perverſe people *." Dr Keill alſo addreſſed his anſwer to the foregoing diſſertation, to Dr Mead: "For," ſays he to him, "as my adverſary has beſought "you to be his patron, ſo I deſire to leave this con-"troverſy to your determination, who are a fit and "learned judge of it. And for your part, great Sir, "who hold the firſt rank in phyſic, be pleaſed ſo to "moderate by your prudence the diſputations of thoſe "who differ in opinion, that they may not be con-"temptible to the unlearned, but profitable to the "learned †." Theſe papers were written at firſt in Latin, printed in the Philoſophical Tranſactions, and dated, the former January, the latter June, 1719: from which it appears, that Dr Mead was applied to by the ableſt men, as a fit moderator and judge in the moſt difficult queſtions, although he was not much

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* Keill's eſſays on ſeveral parts of the animal œconomy, p. 54. Lond. 1738. † Ibid. p. 79. 84.

beyond that period of life when the generality of his profeſſion begin to emerge.

It is remarkable, that party-principles never influenced this great man's attachments: and though he was himſelf a very hearty Whig, yet he was upon terms of the ſtricteſt intimacy with Garth, Arbuthnot, and Freind. And when the laſt, upon a ſuſpicion of being concerned againſt the government with Biſhop Atterbury, was committed a priſoner to the Tower in 1723, Dr Mead conſtantly viſited him, and became one of his ſureties to procure his enlargement. But what contributed to cement the friendſhip between Freind and Mead, was a common quarrel they had been engaged in ſome years before. Dr Mead having had frequent opportunities of experiencing the efficacy of purgatives to prevent, or at leaſt to leſſen, the ſecondary fever, which ſo often proves fatal in the confluent ſmall-pox, communicated this method of practice to ſeveral of his brethren, particularly to Ratcliffe and Freind. Freind adopted it; and in his Commentary on the firſt and third books of Hippocrates's epidemics, publiſhed in 1717, inſerted the letter which Mead had written to him upon that ſubject ſome years before. Theſe two gentlemen being now conſidered as aſſociates in the ſame cauſe, a party was immediately formed againſt the new practice and its favourers; at the head of which was Dr John Woodward, phyſic-profeſſor at Greſham college, who publiſhed, upon this occaſion, The ſtate of phyſic and diſeaſes, with an inquiry into the cauſes of the late increaſe of them, but more particularly of the ſmall-pox. In this performance Dr Woodward was not content with condemning the practice, but treated its favourers with contempt and ill manners, and more particularly our author; whoſe reſentment, though juſt and well grounded, appears nevertheleſs to have been carried to a very exceptionable length, ſeeing it had not ſubſided twenty years after the death of his antagoniſt *.

In 1719, when the plague was ſo fatal at Marſeilles, the Lords of the Regency directed Mr Secretary Craggs to apply to Dr Mead, as a man the beſt qualified to find out the moſt effectual methods to prevent its ſpreading. This occaſioned the publication of his *Short diſcourſe concerning peſtilential contagion, and the methods to be uſed to prevent it*, in 1720; which was ſo greedily received, that no leſs than ſeven editions were printed in one year. The eighth, which appeared in 1723, was enlarged with many new obſervations, and a whole chapter on the method of cure; and the laſt, in 1744, was not without improvements.

In 1723, Dr Mead pronounced the *Oratio Harveiana* before the college of phyſicians, which was publiſhed in 1724; and to it was annexed, *Diſſertatio de nummis quibuſdam a Smyrnæis in medicorum honorem percuſſis*. This oration was attacked with ſome ſmartneſs by the moſt ingenious and learned Dr Conyers Middleton, in a piece, entitled, *De medicorum apud veteres Romanos degentium conditione diſſertatio, in qua, contra viros celeberrimos Jacobum Sponium & Richardum Meadium, ſervilem atque ignobilem eam fuiſſe oſtenditur* †. Mead's ſide of the queſtion was defended by Dr John Ward, late profeſſor of rhetoric in Greſham college; whom Dr Middleton, in a reply, treated with much contempt. Nevertheleſs, he every where expreſſes the greateſt regard for Dr Mead; and, in a work publiſhed ſeveral years after, mentions him in the moſt honourable manner. He is ſpeaking of an antique picture, which he ſuppoſes to be the firſt, and the only one of the ſort ever brought to England; *donec Meadius noſter*, ſays he, *artis medicæ decus, qui vitæ revera nobilis, vel principibus in republica viris, exemplum præbet, pro eo, quo omnibus fere præſtat, artium veterum amore, alias poſtea quaſdam & ſplendidiores, opinor, Roma quoque deportandas curavit* *.

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* Preface to his treatiſe on the ſmall-pox and meaſles.

† Middleton's works, vol. iv.

In 1727, ſoon after his late Majeſty's acceſſion to the throne, he was appointed one of the royal phyſicians; and for many years was engaged in the conſtant hurry of an extenſive and ſucceſsful practice. When, through age, he was grown unequal to the diſcharge of more active functions, and retirement was become abſolutely neceſſary, he took the opportunity to reviſe his former writings. Some have already been mentioned, which were republiſhed in this ſeaſon of his life; and in 1747, came out his diſcourſe, *De variolis & morbillis*, to which was annexed a treatiſe on the ſame diſeaſes, by the celebrated Arabian phyſician Abubeker Rhazes, faithfully tranſlated from the original Arabic into Latin. A copy of the only remaining Arabic manuſcript of Rhazes's treatiſe was communicated from Leyden by the celebrated Boerhaave; between whom and our author there always ſubſiſted a very friendly correſpondence. In his diſcourſe upon the ſmall-pox, there is a chapter upon inoculation; from which it appears, that he was greatly concerned in introducing and eſtabliſhing this laudable practice among us.

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* Germana quædam antiquitatis eruditæ monumenta, p. 2. Works, vol. iv.

The year 1749 furniſhed out two new productions from our author; namely, *Medica ſacra, ſive de morbis inſignioribus qui in Bibliis memorantur commentarius*; and, *A diſcourſe on the ſcurvy*, annexed to Mr Sutton's ſecond edition of his method for extracting the foul air out of ſhips. The laſt, and, as ſome think, the moſt uſeful of all his works, is his *Monita et Præcepta medica*, publiſhed in 1751. Here, with great candour and ſimplicity, he communicates all the diſcoveries that long practice and experience had opened to him, concerning diſeaſes and their cures; and concludes with many ſalutary directions for preſerving the body and mind, perfect and entire, to a good old age. Though his faculties do not ſeem to have been at all impaired in this laſt work, yet he did not find himſelf in a condition to finiſh any thing further; but gently decaying, and growing weaker every day, he expired upon the 16th of February 1754, without viſible ſigns of pain, and was buried on the 23d in the Temple church, near his brother Mr Samuel Mead, an eminent counſellor at law, who died twenty years before.

Dr Mead was twice married. By his firſt wife, Ruth, the daughter of Mr John Marſh, merchant of London, whom he married in 1699, and who died in 1719, he had eight children; four of whom died in their infancy. Of the reſt, the ſecond daughter, now deceaſed, was married to the late Charles Bertie, of Uffington in Lincolnſhire, Eſq; the eldeſt to Dr (now Sir) Edward Wilmot, and the youngeſt to Dr

Francis Nichols, both phyſicians in ordinary to his Majeſty. His only ſon, Richard Mead, is married to Anne, the daughter of William Gore, Eſq; of Tring in Hertfordſhire. The Doctor's ſecond wife, who is ſtill living, was Anne, daughter of Sir Rowland Alſton, Bart. of Odell in Bedfordſhire, whom he married in Auguſt 1724, but had no iſſue by her.

To attempt a formal eloge of this great man, would be impertinent in a preface to his works; and eſpecially after what has been occaſionally dropped in the courſe of theſe memoirs. There is however one circumſtance relating to him which deſerves to be mentioned, becauſe it is uncommon; which is, that, by his ſingular humanity and goodneſs, he conquered even envy itſelf: and accordingly this compliment was juſtly paid him in a dedication, by the editor of Lord Bacon's works, in the year 1730.

It would be impertinent in like manner, becauſe it would be tedious, to enumerate the great and various ſervices he did to the republic of letters. Let it ſuffice to obſerve, what indeed every body knows, that few princes have ſhewn themſelves equally generous and liberal, in promoting ſcience, and encouraging learned men: and this is the true reaſon why Dr Mead, notwithſtanding the immenſe gains ariſing from his profeſſion, did not die ſo rich as might have been expected.

As to his literary collections and other curioſities, the world has already been acquainted with their value and contents by printed catalogues; and it may perhaps be ſaid, not unjuſtly, that no ſubject in Europe had a library and a cabinet ſo richly and ſo judiciouſly furniſhed. Nor did he make this great collection merely for his own uſe, but freely opened it to others; ſo that ingenious men were ſure of finding at Dr Mead's the very beſt helps in all their undertakings.

He maintained a conſtant correſpondence with all the literati in Europe; and his reputation as a ſcholar, as well as a phyſician, was univerſally eſtabliſhed. There cannot be a better proof of this, than the King of Naples ſending him the two firſt volumes of Signior Bajardi's of the antiquities found in Herculaneum; with the additional compliment of aſking in return, only, a complete collection of his own works. This prince at the ſame time invited him to his palace, that he might have an opportunity of ſhewing him all thoſe valuable monuments of antiquity; and Dr Mead uſed to declare to his friends, that his years alone reſtrained him from undertaking a journey ſo ſuited to his taſte and inclination.

Upon the whole, no foreigner of any learning, taſte, or even curioſity, ever came to England, without being introduced to Dr Mead, as it would have been a matter of reproach to have returned without ſeeing him. On theſe occaſions, his table was always open; where, what ſeldom happens, was united the magnificence of princes with the pleaſures of philoſophers.

To conclude: He was ſincerely the friend of all ingenious and learned men, at home and abroad; of Pope, of Halley, of Newton, with whoſe portraits his houſe was furniſhed. He preſented to the college of phyſicians a marble buſto of Harvey, done by an excellent hand, from an original picture in his poſſeſſion; to which his own has been added by Dr Aſkew, done by Roubilliac, and placed near Dr Harvey.

His ſon has likewiſe cauſed a handſome monument to be erected to his memory in Weſtminſter-abbey, with the following inſcription by Dr Ward, of Greſham-college.

M. S.

V. A. RICHARDI MEAD ARCHIATRI
ANTIQVA APVD BVCKINGENSES FAMILIA NATI
QVI FAMAM HAVD VVLGAREM MEDICINAM FACIENDO
IN PRIMA IVVENTVTE ADEPTVS
TANTA NOMINIS CELEBRITATE POSTEA INCLARVIT
VT MEDICORVM HVIVS SAECVLI PRINCEPS HABERETVR
IN AEGRIS CVRANDIS LENIS ERAT AC MISERICORS
ET AD PAVPERES GRATVITO IVVANDOS SEMPER PARATVS
INTER ASSIDVAS AVTEM ARTIS SALVTARIS OCCVPATIONES
OPERIBVS NON PAVCIS DOCTE ET ELEGANTER CONSCRIPTIS
QVAE INGENIO PERSPICACI ET VSV DIVTVRNO NOTAVERAT
IN GENERIS HVMANI COMMODVM VVLGAVIT
LITERARVM QVOQVE ET LITERATORVM PATRONVS SINGVLARIS
BIBLIOTHECAM LECTISSIMAM OPTIMIS ET RARISSIMIS LIBRIS
VETERVMQVE ARTIVM MONVMENTIS REFERTAM COMPARAVIT
VBI ERVDITORVM COLLOQVIIS LABORES LEVABAT DIVRNOS
ANIMO ITAQVE EXCELSO PRAEDITVS ET MORIBVS HVMANIS
ORBISQVE LITERATI LAVDIBVS VNDIQVE CVMVLATVS
MAGNO SPLENDORE ET DIGNITATE VITA PERACTA
ANNORVM TANDEM AC FAMAE SATVR PLACIDE OBIIT
XIIII KALENDAS MARTIAS A. D. MDCCLIV AETATIS SVAE LXXXI
ARTIVM HVMANIORVM DAMNO HAVD FACILE REPARABILI
QVIBVS IPSE TANTVM FVERAT DECVS ET PRAESIDIVM
BIS MATRIMONIO IVNCTVS
EX PRIORI DECEM SVSCEPIT LIBEROS
QVORVM TRES TANTVM SVPERSTITES SIBI RELIQVIT
DVAS FILIAS VIRIS ARCHIATRORVM HONORE ORNATIS NVPTAS
ET VNVM SVI IPSIVS NOMINIS FILIVM
QVI PIETATIS CAVSA PATRI OPTIME DE SE MERITO
MONVMENTVM HOC PONI CRAVIT

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THE

THE WORKS OF Dr RICHARD MEAD.

A Mechanical Account of Poiſons.

In ſeveral Essays.

ADVERTISEMENT.

THis book was firſt publiſhed in the year 1702, and reprinted, with very few additions, in 1708. I then really intended never more to trouble myſelf about it: but the demand for it having for many years been ſo great, as to tempt ſome bookſellers to print it twice or thrice, very incorrectly, in a piratical way (as they call it), without my knowledge; I have thought it right, both in juſtice to the public and myſelf, to give a new edition of it.

It will eaſily be believed, that after more than forty years (ſpent neither without ſtudy nor experience) I cannot be fond of a little performance in phyſic, written at a time of life, in which the facts muſt, for the moſt part, be taken from other authors, and the reaſonings upon them would often require more patient thinking, and a riper judgment. And therefore I make no doubt but the public always made great allowances upon this account, when they gave the book ſo favourable a reception.

In return to this kind uſage, I have now taken ſome pains to reconſider my ſubject. Beſides many other improvements, I have often from my theory drawn obſervations, uſeful, as I imagine, in practice. Neither have I been aſhamed, on ſome occaſions, (as the Latins ſaid), *cadere vineta mea*, to retrench or alter whatever I have judged to be wrong. *Dies diem docet*. I think truth never comes ſo well recommended, as from one who owns his error: and it is allowed that our firſt maſter, Hippocrates, never ſhewed more wiſdom and greatneſs of mind, than in confeſſing his miſtake, in taking a fracture of the ſcull for the natural ſuture [*]; and the compliment which Celſus [†] makes to him on this occaſion, is very remarkable and juſt: *More ſcilicet*, inquit, *magnorum virorum, et fiduciam magnarum rerum habentium. Nam levia ingenia, quia nihil habent, nihil ſibi detrahunt: magno ingenio, multaque nihilominus habituro, convenit etiam ſimplex veri erroris confeſſio; præcipueque in eo miniſterio, quod utilitatis cauſa poſteris traditur.*

I might however urge in my excuſe, that as the notions I have retracted, regard chiefly the nervous fluid, and its properties; ſo my new reaſonings are founded upon experiments of electricity and attraction, applied to this fluid, which at the time of my writing were not known. The inſtructive queries and ſuppoſitions of Sir Iſaac Newton, and the ſurpriſing electrical operations of Mr Stephen Gray *, improved by Monſieur du Fay at Paris †, had not then enlightened the learned world.

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[*] Epidem. lib. 5. § 14.

[†] Medicin. lib. 8. c. 4.

But there are here two additions, which I ought particularly to mention: the firſt is the introduction. Having obſerved, that the action of poiſons, though they are of very different kinds, is generally uniform; and alſo, that the animal ſpirits are firſt affected by it; I have thought it proper, as this opinion may ſeem ſomewhat ſtrange and ſingular, to premiſe an inquiry into the nature of the nervous fluid, of which it muſt be owned that we know too little. And if, in a matter ſo abſtruſe and difficult, what I have advanced has more in it of conjecture than of demonſtration, it may be allowed to be ſomething.

Quadam prodire tenus, ſi non datur ultra ‡.

Whoever will paſs a judgment upon ſuch nice ſpeculations, muſt take the whole ſcheme together. Truth is always a connected ſcheme; and inferences juſtly drawn not only illuſtrate, but confirm one another.

The other addition is, "An anatomical deſcription of thoſe parts in a viper, and in a rattle-ſnake, which are concerned in their poiſon," by our great anatomiſt the learned and ingenious Dr Nicholls. He having taken notice, that the anatomical obſervations on the viper, by Dr Areſkine, in the firſt edition, were neither complete, nor in every point true, has been pleaſed to give a new anatomy of the whole head, not only of the common viper, but alſo of that

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* Vid. Phil. Tranſ. 1733, 1734, 1737.

† Vid. Memoires de l'Academie.

‡ Horat. Epiſt. 1. v. 32.

larger kind of it, the rattle-ſnake: that ſo thoſe parts which cannot ſo eaſily be ſeen in the ſmaller, may more diſtinctly appear in the bigger animal. How accurately he has performed this taſk, and how thoroughly he has explained the mechaniſm and offices of the ſeveral organs, any one may judge, who will compare his deſcriptions with the beſt of thoſe which have been hitherto made by other anatomiſts.

The PREFACE to the FIRST EDITION.

TO give an exact and particular account of the nature and manner of the action of poiſon, is no eaſy matter; but to diſcourſe more intelligibly of them, than authors have hitherto done, not very difficult. One may without much pains ſhew their effects to be owing to ſomething more than the bare qualities of heat or cold; and diſcover the footſteps of mechaniſm in thoſe ſurpriſing phænomena, which are commonly aſcribed to ſome occult or unknown principle. But to unravel the ſprings of the ſeveral motions upon which ſuch appearances depend, and trace up all the ſymptoms to their firſt cauſes, requires ſome art as well as labour; and that both upon the account of the exquiſite fineneſs and marvellous compoſition of the animal machine in which they are tranſacted, and of the minuteneſs of thoſe bodies which have the force to induce in it ſuch ſudden and violent alterations.

I have attempted ſomewhat this way in the following eſſays; in which I do not promiſe methodical and finiſhed treatiſes, but only ſome ſhort hints of natural hiſtory, and rude ſtrokes of reaſoning ; which, if put together and rightly improved, may perhaps ſerve to furniſh out a more tolerable ſpecimen of the doctrine of poiſons, than has yet been publiſhed.

The firſt draught of this ſmall piece I made ſome years ſince, entertaining myſelf at leiſure-hours with experiments on vipers, and other venomous creatures ; examining now and then the texture of arſenic, mercury ſublimate, and the like malignant ſubſtances ; turning over what authors had ſaid on the ſeveral ſubjects, and making ſuch remarks as from time to time occurred.

Theſe continued inquiries made up at laſt three or four ſhort diſcourſes ; which when I began to digeſt into order, the increaſe of buſineſs contracted the intervals of my ſpare time ; and the diverſion of ſuch ſtudies quickly giving way to the ſeverity of more neceſſary labours, they were quite thrown by. Till talking not long ſince with Dr Areſkine concerning the viper, I took occaſion to review my ſcattered papers, and confirm my reaſonings by new experiments. He very readily offered me his anatomical obſervations. Theſe I have put at the end of the firſt eſſay : which do not promiſe a complete diſſection of the animal, but chiefly ſhew the make of thoſe parts which are concerned in the poiſon.

My deſign, in thinking of theſe matters, was, to try how far I could carry mechanical conſiderations in accounting for thoſe ſurpriſing changes which poiſons make in an animal body ; concluding (as I think, fairly) that if ſo abſtruſe phænomena as theſe come under the known laws of motion, it might very well be taken for granted, that the more obvious appearances in the ſame fabric are owing to ſuch cauſes as are within the reach of geometrical reaſoning: and that therefore as the firſt ſtep towards the removal of a diſeaſe is to know its origin; ſo he is likely to be the beſt phyſician, who, having the ſame aſſiſtance of obſervations and hiſtories with others, beſt underſtands the human œconomy, the texture of the parts, motions of the fluids, and the power which other bodies have to make alterations in any of theſe.

Nor indeed ought any one to doubt of this, who conſiders that the animal compages is not an irregular maſs, and diſorderly jumble of atoms, but the contrivance of infinite wiſdom, and the maſterpiece of that creating power, who has been pleaſed to do all things by eſtabliſhed laws and rules, and that harmony and proportion ſhould be the beauty of all his works.

It were therefore heartily to be wiſhed, that thoſe gentlemen who are ſo much afraid of introducing mathematical ſtudies, that is, demonſtration and truth, into the practice of phyſic, were ſo far at leaſt inſtructed in the neceſſary diſciplines, as to be able to paſs a true judgment, what progreſs and advances may be made this way. They would not then perhaps decry an attempt of ſo much moment to the welfare of mankind, as vain and impoſſible; becauſe it is difficult, and requires application and pains.

It is very evident, that all other methods of improving medicine have been found ineffectual, by the ſtand it was at for above two thouſand years: and that ſince of late mathematicians have ſet themſelves to the ſtudy of it, men already begin to talk ſo intelligibly and comprehenſibly, even about abſtruſe matters, that it may be hoped in a ſhort time, if thoſe who are deſigned for this profeſſion, are early, while their minds and bodies are patient of labour and toil, initiated in the knowledge of numbers and geometry, that mathematical learning will be the diſtinguiſhing mark of a phyſician from a quack; and that he who wants this neceſſary qualification, will be as ridiculous as one without Greek or Latin.

I have, as to what regards the animal œconomy, referred as much as I could to the works of Bellini, which have brought great light into the dark regions of phyſic, and taught us to argue clearly and conſiſtently, inſtead of amuſing ourſelves with unintelligible words or precarious hypotheſes. The diſſertations of Dr Pitcairne, the honour of his profeſſion in Scotland, are a convincing proof of the advantage of ſuch a mechanical way of reaſoning: nor could malice itſelf deny this, were not ignorance in confederacy with it, which will ſecure any one from being benefited by the moſt uſeful demonſtrations.

Notwithſtanding this, I have been forced now and then to make digreſſions from my ſubject, to clear ſome doctrines neceſſary to be known, which have not been explained by others. For indeed the data from which we argue in theſe matters, are by many too few. Dr Cheyne, the author of the new theory of fevers, has enumerated ſeveral particulars, in which the theoric part of medicine ſtill wants improvement. If theſe deficiencies were made good, we might with more eaſe proceed in our inquiries into human nature; and ſhould ſoon convince the world, that the moſt uſeful of arts, if duly cultivated, is more than mere conjecture, or baſe empiriciſm.

As to the authors I have made uſe of, who have treated of poiſons, I have quoted only thoſe who furniſhed me with matter of fact: for there are but few originals; and very large volumes on this ſubject many times contain little more than a collection of vulgar errors.

I had once thought to have carried theſe ſearches farther; in particular, beſides what is occaſionally mentioned in the laſt eſſay concerning infection in acute diſeaſes, to have inquired into the nature of contagious and hereditary diſtempers. But the humour of ſcribbling would not hold out; and ſome perhaps will ſay, it is well enough it did not: for I am not ignorant, how few I am like to pleaſe. If it be hard to think and write juſtly, it is harder yet to bring others to one's own taſte; nor ſhall I be at all angry if to many I have afforded matter of ſatire and invective: leſs wit ſuffices for theſe, than for the diſcovery of uſeful truths. They who have no ſmattering of mathematical knowledge, are incompetent judges of what ſervice I have done towards the improvement of the theory, or practice of medicine; and thoſe who are acquainted with theſe matters, will, it may be, think it ſomething to talk intelligibly on ſuch difficult and abſtruſe points. I neither want applauſe, nor fear cenſure: and therefore be the fate of theſe papers what it will, as they were firſt penned for my own ſatisfaction, and innocent entertainment; ſo I am reſolved they ſhall never engage me in the trouble of quarrels or diſputes.

London, 1702.

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INTRODUCTION.

THoſe things which are experienced to be in their whole nature, or in their moſt remarkable properties, ſo contrary to the animal life, as in a ſmall quantity to prove deſtructive to it, are called poiſons; whether they are hurtful by being taken inwardly at the mouth, or communicated to the body externally by a wound.

This ſubject has afforded matter for great diſputes among philoſophers, in their inquiries into the frame of the world. Some have made it an objection to the goodneſs of the Creator, that there ſhould be any ſuch productions as poiſons in nature: on the other hand, Paracelſus, Van Helmont, and their followers, fond of magnifying their chemical art, tell us, that poiſons are really deſigned for other purpoſes than is commonly thought; they being indeed great medicines, when their concealed uſeful qualities are, by our ſtudy and labour, diſcovered and brought out of them *. To prove this, they allege that remarkable ſaying of the wiſe man †: "God made not "death, neither hath he pleaſure in the deſtruction "of the living. For he created all things, that they "might have their being; and the generations of the "world were healthful: and there is no poiſon of "deſtruction in them, nor the kingdom of death "upon the earth."

As the knowledge of thoſe minute philoſophers, who find faults in the diſpoſition of the univerſe, is generally too ſuperficial; ſo I doubt the reaſoning against

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* Vid. J. B. Van Helmont opera, pag. 373. † Wiſdom of Solomon, chap. 1. ver. 13.

gainſt them of our adepts, whoſe ſight is often dazzled by the light of their furnaces, will, in the preſent affair, appear too deep, and far-fetched. For it does not look like univerſal beneficence, to create ſubſtances, whoſe manifeſt and obvious qualities are noxious and deſtructive, though they may have other virtues which are ſalutary, but which are only to be extricated from them by deep ſearches of art, and the torture of the fire.

The true ſtate of the caſe ſeems to be this. The productions of nature of this kind, as to us, are often medicinal, either in the external or internal uſe of them; and experience, improved by reaſoning, teaches us to prepare and apply them to various purpoſes: but they are alſo not only phyſic, but even food to ſome other animals, which, by natural inſtinct, devour them; and theſe themſelves afford not only good nouriſhment, but ſometimes remedies to us. Little inſects, which we think troubleſome, are neceſſary to the life of wholeſome birds and other creatures. Goats and quails are fattened by hellebore *, ſtarlings by hemlock †, and hogs innocently eat henbane ‡; all which we call poiſonous. Many inſtances might be given of the like kind. Will any one ſay that the venom of the viper is not made for our good, when without it (as will be obſerved in the following diſcourſe) this reptile could not have been provided with thoſe noble qualities, which render it effectual againſt ſome very ſtubborn diſeaſes?

But this queſtion may perhaps ſeem more difficult with regard to poiſonous minerals: as, for inſtance,

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* Lucret. lib. 4. 645. † Galen. Simpl. Medic. Fac. lib. 3. c. 18. ‡ Sext. Empiric. Hypoth. Emp. 1.

arſenic, which we find to be diffuſed almoſt through the whole mineral kingdom. Now, it muſt be obſerved, that this is not a perfect mineral, but an active ſubſtance made uſe of by nature in preparing ſeveral metals in the earth, which are of great ſervice to mankind. It particularly appears to be ſo in the growth of ſilver, copper, tin, and lead; the ores of all which contain, beſides common ſulphur, a great deal of arſenic: ſo that this, in the language of the chemiſts, may be called a mineraliſing principle. And the caſe will be found to be much the ſame in all natural productions of this kind.

In ſhort, there is in the fabric of the world a great chain and dependency of things upon one another: and though our knowledge does not reach to every particular link of it, yet the farther we advance in the ſtudy of nature, the more we ſhall find that

> Whatever is, is right *.

But how much more would it appear to be ſo, could we look into the whole ſyſtem of the univerſe, and ſee the relation which our world perhaps bears to ſome of thoſe innumerable others in the immenſe ſpace, which the almighty being may probably have made dependent upon one another by eſtabliſhed laws and order!

As to the text cited out of Solomon, the meaning of it is plainly this. "God created nothing to be "deſtructive to mankind, but gave to all things their "proper nature; and the productions of the world "are wholeſome. Even poiſons were not deſigned "to be hurtful, but for good uſes: for in all

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* Pope's Eſſay on man, epiſt. 1.

" the earth there are proviſions made againſt death."

Before we proceed to particulars, it may not be improper to give a general idea of poiſons, to explain in what manner they act, and by what alterations made in our bodies they become ſo hurtful.

Now, as to this, it will appear from the following diſcourſes, that though poiſons are of different kinds, as well thoſe which kill by wounds, as thoſe which are taken inwardly; yet there is a great agreement in the manner of producing their effects; and that even internal poiſons exert their force in a manner analogous to the external.

Venomous animals, when they bite or ſting, inflict a wound, and inſtil into it a drop or more of liquor, which infects the fluid of the nerves, and by this means inflames the membranes: hereupon a ſwelling ariſes, ſometimes to a degree of mortification, which ſpreads to the neighbouring parts.

Poiſonous ſubſtances, being ſwallowed, wound the nervous coat of the ſtomach. An inflammation enſues, which, according as the poiſon is of a greater or leſſer power, is communicated to the contiguous coats; and in ſome caſes, eſpecially if it be of a mineral nature, ends in a perfect gangrene. For the difference between mineral and vegetable poiſons lies chiefly in this, that the former are of greater force than the latter.

But in all accidents of this kind, whether the wound be outward or inward, the miſchief does not ſtop at the part affected, but it is carried farther, even through the whole body.

This is done by the great activity of the nervous fluid, one part of which being infected immediately taints all the reſt: and thus the whole ſyſtem of nervous expanſions is drawn into ſpaſms and convulſions; which, according to the different offices of the parts to which the nerves belong, produce different ſymptoms. In the ſtomach and inteſtines, theſe ſpaſms cauſe ſickneſs, vomitings, and gripes; in the brain, deliria, ſleepineſs, and epileptic fits; in the heart, intermiſſions of the arterial pulſe, palpitations, and ſwoonings; in the lungs, difficulty of breathing, with ſtrangling and ſuffocations; in the liver, by the ſpaſmodic contraction of the biliary ducts, the bile is returned into the blood, and makes a jaundice; in the kidneys, the ſame diſpoſition of the urinary canals interrupts the ſecretion of urine, and makes it quite irregular. In ſhort, the animal œconomy is all diſturbed: and though different poiſons may ſhew their moſt remarkable effects in different parts, and theſe, according to the violence of the hurt, may appear in very different degrees; yet the ſymptoms always make it plain, that the firſt bad impreſſion is made upon the animal ſpirits.

I have in another place ſhewn, from the manner in which perſons are ſeized in peſtilential fevers, that is, with faintneſs, giddineſs, palpitations of the heart, tremblings, &c. that the nervous fluid is likewiſe principally affected in theſe diſeaſes; contagion being indeed a real poiſon *.

It will therefore be proper to inquire into the nature of this liquor: for I think no regard ought to be had to the immechanical notions of thoſe authors who imagine that there is no ſuch thing in an animal body; and that muſcular motion and ſenſation are

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* Vid. Diſcourſe on the plague.

performed only by the vibrations of the fibres of the nerves, without the intervention of any ſpirituous fluid.

They who can ſatisfy themſelves with ſuch a ſcheme, ſeem to have very little attended to what is tranſacted within us, in the effects of ſudden paſſions of the mind; in the inſtantaneous tranſlations of diſeaſes from one part to another, as particularly in the gouty humour; and in the ſurpriſing changes made ſometimes in a moment, in the ſecretions of thoſe liquors upon which life depends.

But, to ſay no more, as the brain is manifeſtly a large gland, with a moſt exquiſite apparatus for the ſeparation of a liquor from the blood; this muſt, like all other glands, have an excretory duct: now, the nerves are evidently contrived for this purpoſe, and conſequently muſt always contain a proper ſubtile juice.

To proceed therefore; this fluid, ſo far as we can diſcover by its effects, is a thin volatile liquor, of great force and elaſticity; being indeed moſt probably a quantity of the univerſal elaſtic matter, incorporated with fine parts of the blood, ſeparated in the brain, and lodged in the fibres of the nerves. This is the inſtrument of muſcular motion and ſenſation, a great agent in ſecretions, and indeed in the whole buſineſs of the animal œconomy.

By the univerſal elaſtic matter I underſtand that ſubtile and active ſubſtance, diffuſed throughout the univerſe, which our great philoſopher, Sir Iſaac Newton, ſuppoſes to be the cauſe of the refraction and reflection of the rays of light, and by the vibrations of which light communicates heat to bodies; and which readily pervading all bodies, produces many of their actions upon one another.

I refer, for the ſentiments of this divine man, to his Optics *; but more eſpecially to a moſt remarkable letter of his to the Honourable Mr Boyle, written many years ſince †. Whoever thoroughly comprehends and conſiders what is delivered in theſe pieces, under the form of queries and ſuppoſitions, will be let into ſome knowledge of the ſecret ſprings of nature; and will then, I hope, be inclined to think, that I have not been wrong in endeavouring to introduce the ſame principles from the inanimate into the animated world.

It ſeems very reaſonable, from that uniformity which there is in the laws of nature, to conclude that the animal ſpirits are ſomething of this kind; for there can be no greater preſumption in favour of a ſcheme, than that it is ſimple, and of a piece with the known ſyſtem of the univerſe.

Now, an active ſubſtance of this kind in the nerves, muſt neceſſarily be very ſuſceptible of alterations from other bodies of extreme minuteneſs and great force: in like manner as we ſee ſome chemical liquors, upon their firſt approach to each other, to fall into fermentations; the reſult of which is a compound mixture of a quite different nature, from what might have been expected from the ſingle ingredients.

Thus the compound ſpirit of nitre put to oil of cloves will effervesce even to a flame; a fermentation

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* Qu. 23. 24. † Publiſhed in the life of Mr Boyle, prefixed to his works, p. 70. which life is ſince printed by itſelf.

being indeed no more than the attraction and repulſion of the particles of different bodies, when they come together.

By reflecting upon the phænomena which the experiments of late years made upon electricity * have diſcovered to the world, and viewing the attractions and repulſions of the fineſt particles of electrical ſubſtances, any one may eaſily form an idea of this animal fluid, and of the exceſſive force and velocity with which it acts.

It is very obſervable, that the communication of electricity is much greater through animal than through inanimate bodies: that is, the elaſtic fluid paſſing through theſe meets with a greater quantity of the ſame matter in them than in the other; the ſolid animal fibres being more adapted to receive it. The experiment of the boy ſuſpended on ſilk or hair lines † is equally ſurpriſing and inſtructive, demonſtrating this elaſtic ſpirit, even to our ſight and touch. And if the nerves, as Sir Iſaac Newton ſuppoſes, are very ſmall, but ſolid, pellucid and uniform capillamenta, wrapt up in bundles; the glaſs tube rubbed by the hand, and its action with the elaſtic fluid, repreſent to us in ſome degree the nerves and the animal ſpirits lodged in them.

Perhaps the proſecution of ſuch trials upon living creatures, may in time make us more acquainted with the laws and actions of this impetuous part (as Hippocrates ‡ calls it) in the animal machine.

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* Philoſ. Tranſact. N° 366. 417. 422. 423. 426. 436. 439. 444. † Ibid. N° 417. ‡ Epidem. lib. vi. § 8. Τὰ ὁρμῶντα σώματα.

Ita res accendunt lumina rebus *.

It is ſufficient to our preſent purpoſe, to have deſcribed the nervous fluid ſo far, as to ſhew it to be ſuch a one as is endowed with great activity and force, and therefore capable of receiving various alterations from other bodies, eſpecially ſuch as conſiſt likewiſe of very ſubtile and powerful particles: and all poiſons, we know, are of this kind.

I was of opinion, when I firſt wrote theſe eſſays, that the effects of poiſons, eſpecially thoſe from venomous animals, might be accounted for by their affecting the blood only: but the conſideration of the ſuddenneſs of their miſchief, too quick to be brought about in the courſe of the circulation, (for the bite of a rattle-ſnake killed a dog in leſs than a quarter of a minute †), together with the nature of the ſymptoms entirely nervous, induced me to change my ſentiments. For if, as Dr Keill has computed ‡, the velocity of the blood is more than five thouſand times leſſer at the fortieth branch from the great artery, than it is in this artery before any ramification is made from it; how is it poſſible, that the brain, heart, &c. ſhould feel ſo ſudden a hurt, unleſs it were conveyed to them by a medium of much greater quickneſs? and this can be no other than the animal ſpirits.

Neither is it amiſs to add, that the obſervations I have made, if improved, may alſo afford hints uſeful in the cure of many diſeaſes. For, though ſome of thoſe diſtempers which we call nervous, as particularly paralytic weakneſſes, may be accounted for by irregular motions and obſtructions of the animal ſpirits only; yet many of them certainly muſt ariſe from ill affections of the ſpirituous fluid itſelf. It can, for inſtance, never be conceived that the ſurpriſing appearances in phrenitical, maniacal, and melancholy diſorders, ſhould be brought about without alterations, ſuitable to the different caſes, made in that active liquor, by which the mind governs the body.

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* Lucret. lib. i. ver. 1110.

† Philoſoph. Tranſact. Nº 399.

‡ Vid. Tent. Medico-Phyſic. 2.

There are many other caſes, judged extraordinary, and not eaſily to be explained, which depend almoſt ſolely on the animal ſpirits. I ſhall mention only one.

A ſurgeon of great merit and experience, in a very uſeful book, lately publiſhed *, has obſerved, that ſometimes in gun-ſhot wounds, attended with a great laceration of the membranes, though things ſeem to go on well for ſome days; yet the patient is ſuddenly ſeized with convulſions in his face, which ſo fix the jaws that he cannot ſpeak, though the ſenſes are not impaired, and inevitably dies. It is, I think, very plain, that this dreadful ſymptom muſt be owing to the bad condition of the nervous liquor, which it is brought into by the tearing of the membranes, and which, notwithſtanding the tolerable ſtate of the blood, does, by its own diſorder, produce fatal conſequences.

And, as we ſee in the mentioned electrical experiments, how remarkably the ſubtile matter is altered in its motions and effects, even by the ſimple contact of other bodies; it muſt certainly be allowed, that when the ſame comes to be incorporated with the

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* Ranby on gun-ſhot wounds, p. 72.

fineſt part of the blood, it will, according to the condition in which this is, make a fluid, elaſtic indeed, but at different times in a different degree, and therefore variouſly affected by external agents.

But to return to poiſons: As the different ſtate of the nervous fluid may in ſome meaſure alter their effects; ſo likewiſe theſe themſelves, though really of the ſame kind, may yet ſo differ in their force and degree of action, as to be hurtful in various and ſeemingly different ways.

Upon this conſideration, the ſurpriſing ſtories related by authors, of the different deaths inflicted by ſerpents of different kinds, particularly in Africa, are not at all incredible. I very well remember, that the learned Paul Herman, many years ago profeſſor of botany in the univerſity of Leyden, who had lived a great while in India, affirmed, that there were alſo in ſeveral parts of that country venomous creatures, of the ſame kind with thoſe deſcribed by the African hiſtorians, which killed by very different effects of their poiſon; and that, upon due inquiry into facts, he was convinced that the beautiful deſcriptions in Lucan * of the various ſpecies of vipers which Cato met with in the hot Libyan deſerts, were not poetical fictions, but taken from nature. He had in his muſeum, preſerved in ſpirit of wine, ſeveral of theſe very ſerpents; particularly the Aſpis, called Nintipolongha Zeylanica, whoſe bite induced a deadly ſleep; the Dipſas, or Situla Macaſſarica, which killed with an unquenchable thirſt; and the Hæmorrhous Macaſſaricus, the poiſon of which was immediately followed by hæmorrhages from all the pores of the body.

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* Lib. ix.

For we muſt obſerve likewiſe, that although the firſt impreſſion of the poiſon be made upon the nervous ſpirit, yet the whole maſs of blood very quickly partakes of the hurt: not, I ſuppoſe, from any mixture of the venom with it, but from ſuch a corruption of it, as an irregular circulation, interrupted ſecretions, and ſtagnations in the ſmalleſt veſſels, (the conſequences of a vitiated nervous fluid), may naturally produce. Nor will this ſeem ſtrange, ſince ſuch a compounded liquor as the blood is, may certainly undergo any imaginable changes by alterations made in its motion only.

Thus much concerning the general action of poiſons: the effects of the particular kinds of them, deſcribed in the following diſcourſes, will (at leaſt in my opinion) be ſo many proofs of the truth of the doctrine I have advanced.

ESSAY I.

OF THE VIPER.

THE viper has always been ſo remarkable for its venom, that the moſt remote antiquity made it an emblem of what is hurtful and deſtructive. Nay, ſo terrible was the nature of theſe creatures, that they were very commonly thought to be ſent as executioners of divine vengeance upon mankind for enormous crimes, which had eſcaped the common courſe of juſtice. Thus Herodotus * and Ælian † do both take notice that adders were ſacred among

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* Lib. ii. cap. 74.

† De animalib. lib. xvii. c. 5.

among thoſe maſters of learning and ſuperſtition, the Egyptians; that they affirmed of one ſort of them particularly, that they were made to be miniſters of the will of the gods, by averting evil from good men, and puniſhing the bad. Therefore the goddeſs Iſis was repreſented with an aſp upon her head *, to denote both her wiſdom and power. And from her the Greeks and Romans honoured Minerva with the ſame ſymbol, as ſhe often appears dreſſed in antique ſtatues and gems. And Pauſanias † obſerves of the Arabians, that they forbore to offer any violence to the vipers, which were found near the balſam-tree, as reputing them holy. The footſteps of which ſuperſtition ſtill remain among theſe people to this very day: for Veſlingius ‡ ſaw many of them take theſe creatures into their houſes, feed them and worſhip them as the genii of the place. The ſame odd fancy obtains in the Eaſt Indies: for the king of Calicut cauſes cottages to be ſet up for ſerpents to keep them from the rain, and makes it death to any that ſhall hurt one of them; thinking them to be heavenly ſpirits, becauſe they can ſo ſuddenly kill men ||. A remarkable inſtance of ſuch an opinion as this we have in the hiſtory of St Paul +, whom the people of Malta, when they ſaw the viper leap upon his hand, preſently concluded to be a murderer; and as readily made a god of him, when, inſtead of having his hand inflamed, or falling down dead, (one or other of which is uſually the ef-

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[*] Aſpide cincta comas——— Valer. Flacc. Argonautic. lib. iv. ver. 418. Dextrâ lævâque ſulcis inſurgentium viperarum cohibita. Apuleius Metam. lib. ii. p. m. 240.

[†] Bœtic. p. m. 303.

[‡] Not. in Alpin. de plant. Ægypt. cap. 14.

[||] Purchas's Pilgrimage, book v. chap. 12.

[+] Act. Apoſt. chap. xxviii.

fect of thoſe bites), he without any harm ſhook the beaſt into the fire ; it being obvious enough to imagine, that he muſt ſtand in a near relation at leaſt to the gods themſelves, who could thus command the meſſengers of their vengeance, and counterwork the effects of ſuch powerful agents.

I have ſometimes thought that this might be the reaſon, why antiquity not only repreſented the firſt maſters of phyſic, Hermes, Æſculapius, Hippocrates, &c. in their ſtatues and medals, with a viper added to their figure, but alſo worſhipped them under this form: for diſeaſes in thoſe days, eſpecially the moſt violent, plagues, fevers, &c. were in like manner, as theſe creatures, reputed the commiſſioned meſſengers of divine anger and diſpleaſure *. They therefore who by their art could cure and ſtop the courſe of theſe, as they were ſuppoſed to do this by the particular leave and aſſiſtance of heaven, ſo had honours paid to them accordingly ; and this repreſentation was in the nature of an hieroglyphic character ; for, as the learned Spanheim obſerves †, the viper was a ſymbol or emblem of divine power.

But to ſay the truth, that which the ancients made the ſymbol of health, does not ſeem to have been the viper, but the innocent ſnake or ſerpent of that kind, of which Lucan ſpeaks ‡ :

Vos quoque qui cunctis innoxia numina terris
Serpitis, aurato nitidi fulgore dracones.

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* Cornel. Celſ. præfat. in medicin. Morbos ait ad iram deorum immortalium relatos eſſe, et ab iiſdem opem poſci ſolitam.

† Divinæ potentiæ ſymbolum. Vid. Ezec. Spanheim. de uſu numiſmat. p. m. 125. 126. & 181. & ſeq.

‡ Pharſal. lib. ix. ver. 729.

And if ſo, the reaſon Macrobius gives for this cuſtom may be a very good one; which is from the property all ſerpents have of caſting their exuviæ, or upper ſkin, every year, which makes them fit emblems or repreſentations of health: the recovery whereof from ſickneſs and diſeaſes may juſtly be looked upon as the beginning of a freſh period of life, and (as the throwing off the ſenectus of theſe creatures ſeems to be) the renewing of age *.

Be that as it will, certain it is, that ſuch fond and ſuperſtitious fancies concerning the viper, together with the miſtaken opinion that few of its parts were exempt from poiſon, did not ſuffer the ancients to make any curious inquiries into its nature by anatomy and experiments. And this is the cauſe of the many errors they have delivered down to us in theſe points; which by gradual advances have ſince been rectified, and the inward make, properties, and generation of this animal, have been largely treated of; more eſpecially M. Redi †, Charas ‡, and Dr Tyſon in his diſſection of the rattle-ſnake ||, which is a larger ſpecies of the viper, have taken pains on this ſubject; to whoſe diſcoveries what is yet wanting, we ſhall add at the end of this eſſay.

The ſymptoms which follow upon the bite of a viper, when it faſtens either one or both its greater

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* Ideo ſimulacris eorum [Æſculapii et Salutis] junguntur figuræ draconum, quia præſtant ut humana corpora, velut infirmitatis pelle depoſita, ad priſtinum revireſcant vigorem: ut vireſcunt dracones per annos ſingulos, pelle ſenectutis exuta. Saturnal. lib. 1. c. 20. † Oſſervazioni intorno alle vipere. ‡ Nouvelles experiences ſur la vipere. || Philoſophical Tranſactions, vol. 12. N° 144.

teeth in any part of the body, are an acute pain in the place wounded, with a ſwelling at firſt red, but afterwards livid, which by degrees ſpreads farther to the neighbouring parts; with great faintneſs, and a quick, though low, and ſometimes interrupted pulſe, great ſickneſs at the ſtomach, with bilious, convulſive vomitings, cold ſweats, and ſometimes pains about the navel; and if the cure be not ſpeedy, death itſelf, unleſs the ſtrength of nature prove ſufficient to overcome theſe diſorders: and though it does, the ſwelling ſtill continues inflamed for ſome time; nay, in ſome caſes more conſiderably upon the abating of the other ſymptoms, than at the beginning. And often from the ſmall wound runs a ſanious liquor, and little puſtules are raiſed about it: the colour of the whole ſkin, in leſs than an hour, is changed yellow, as if the patient had the jaundice.

Theſe miſchiefs (although different climates, the ſeaſon of the year more or leſs hot, the greater or leſſer rage of the viper, the animal itſelf of a larger or ſmaller ſize, and conſequently able to communicate more or leſs venom, the wound made deeper, in a part more nervous or tendinous, and therefore receiving more of the poiſonous liquor, and the like circumſtances, may variouſly heighten or abate them, yet) uſually diſcover themſelves much after the ſame manner in all: unleſs the bite happen not to be accompanied with the effuſion of that liquor, which is the main inſtrument and cauſe of this violent and ſhocking diſturbance.

But before I proceed to inquire into the nature and manner of the acting of this juice, it may not be improper to take notice, that the true uſe of it is to perform an office of ſo great moment to the preſervation of the individual, that without it this creature could not ſubſiſt.

For vipers live chiefly upon lizards, frogs, toads, mice, moles, and the like animals, which they do not chew, but ſwallow down whole; in which manner they lie in the ſtomach, or if that be not big enough to receive them, partly in that, and partly in the œſophagus, which is membranous and capable of great diſtenſion; till by the ſalival juices of thoſe parts, together with the help of the fibres of the ſtomach, and the contraction of the muſcles of the abdomen, they are gradually diſſolved into a fluid ſubſtance, fit for the nouriſhment of their bodies, which is the work of many days. This is one reaſon why theſe creatures can live ſo long without taking any freſh food, which I have known them to do five or ſix months; as another is, that their blood is a groſſer and more viſcid fluid than that of moſt other animals: ſo that there is but a very little expenſe of it by tranſpiration, and conſequently leſs need of recruit. This not only microſcopes diſcover, but reaſon teaches: becauſe there is but very little muſcular force in the ſtomach to comminute the food, and make a chyle of fine parts; and therefore the blood muſt accordingly be of a tough and clammy conſiſtence. Beſides, the heart of a viper has properly but one ventricle, and the circulation of the blood is performed after the ſame manner as it is in a frog and tortoiſe, in which not above one third of it paſſes through the lungs: upon which account its comminution in them by the air is proportionally leſſer than in other animals. Now, ſuch a manner of feeding as this does neceſſarily require, that the prey ſhould upon the firſt catching be immediately killed: otherwiſe it were by no means fit to be let into the ſtomach. For we are not to think that the force of this part would be alone ſufficient to deſtroy it, the ſubtilty of a living creature (beſides the conſideration of the weakneſs of the fibres) being in a great meaſure able to elude that; as indeed we every day find live animals in the ventricles of others: and therefore to do this is the proper uſe both of the teeth and their poiſon; for which being deſigned and adapted, it is no wonder if the viper, this ſame way by which it deſtroys its prey, proves ſometimes miſchievous to any other creatures beſides, when it happens to be enraged, or by any provocation ſtirred up to bite.

The deſcription of the poiſonous fangs, their make, articulation, and motion, as alſo of the glands that ſeparate the yellowiſh liquor, and the bags that contain it, I ſhall give, together with ſome anatomical obſervations, at the end of this diſcourſe.

This venomous juice itſelf is of ſo inconſiderable a quantity, that it is no more than one good drop that does the execution. And for this reaſon authors have contented themſelves with trials of the bite upon ſeveral animals, never eſſaying to examine the texture and make of the liquor itſelf: for which purpoſe I have oftentimes by holding a viper advantageouſly, and enraging it till it ſtruck out its teeth, made it bite upon ſomewhat ſolid, ſo as to void its poiſon; which carefully putting upon a glaſs plate, I have with a microſcope, as nicely as I could, viewed its parts and compoſition.

Upon the firſt ſight I could diſcover nothing but a parcel of ſmall ſalts nimbly floating in the liquor; but in a very ſhort time the appearance was changed, and theſe ſaline particles were now ſhot out as it were into cryſtals of an incredible tenuity and ſharpneſs, with ſomething like knots here and there, from which they ſeemed to proceed: ſo that the whole texture did in a manner repreſent a ſpider's web, though infinitely finer, and more minute; and yet withal ſo rigid were theſe pellucid ſpicula, or darts, that they remained unaltered upon my glaſs for ſeveral months *.

I have tried ſeveral ways to find out, if I could, under what tribe of ſalts theſe cryſtals are to be ranged, and to diſcover what alterations they make in the blood: and not without ſome difficulty, by reaſon of the minute quantity of the liquor, and the hazard of experiments of this kind, ſome curious friends, and myſelf together, made the following obſervations.

About half an ounce of human blood received into a warm glaſs, in which were five or ſix grains of the viperine poiſon newly ejected, was not viſibly altered either in colour or conſiſtence: it then was, and remained undiſtinguiſhable from the ſame blood, taken into another glaſs, in which was no poiſon at all.

Theſe portions of blood were ſeverally mixed with acids and alkali's: the empoiſoned blood was, after ſuch mixtures, of the ſame colour and conſiſtence as the other.

Spirit of nitre, ſpirit of ſalt, and juice of lemons ſeverally poured upon the ſanies itſelf, produced neither fermentation, nor any change of colour.

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* Vid. tab. 1. fig. 10.

Salt of tartar run per deliquium, and the ſimple ſpirit of hartſhorn, dropped upon the venom, neither altered its colour, nor raiſed any ebullition.

Syrup of violets mixed with the poiſon did not change its colour either to red or green.

The tincture of heliotropium, that is, blue paper, was not altered by the ſanies ejected upon it: and this drying ſtill retained its yellowiſh colour.

We cauſed ſeveral animals, dogs, cats, and pigeons, to be bit by an enraged viper; which generally died, ſome in a longer, others in a ſhorter ſpace of time. But we conſtantly obſerved, that they all immediately upon the bite ſhewed, with ſigns of acute pain, marks of their life being affected by ſickneſs, faintings, convulſions, &c.

The head of a large viper lay three hours after it was cut off: it was perfectly flaccid and without motion. A pigeon wounded upon the breaſt with the fangs of this head, was preſently convulſed, &c. as from the bite of the animal, and died in ſeven hours.

We contrived a ſharp ſteel needle to be made, crooked, in ſhape not unlike to the viper's tooth, with a ſulcus or hollow on the convex part, not far from the point: into this we put a drop of the venom, and with it wounded the noſe of a young dog.

It produced the uſual diſorders of vomiting, purging, &c. but in a leſs degree, and the dog recovered. It was remarkable, that upon making the wound the dog cried but little, till the poiſon came into it: but then he howled, &c. in the ſame manner as if bit by the viper itſelf. But a pigeon pricked in the fleſhy part of the breaſt by the ſame poiſoned needle, ſuffered as from the bite, and died in about eight hours.

We made theſe laſt experiments, with a view to the controverſy between Signor Redi in Italy, and Monſieur Charas in France. The former, from trials of the ſame kind with thoſe we have now mentioned, affirmed that the venom of the viper lay in the yellow liquor of the gums. The latter, in oppoſition to this, eſpouſed a notion advanced firſt by Van Helmont, and placed it altogether in the enraged ſpirits of the creature, calling this yellow liquor a pure innocent ſaliva; and alleged in proof of his aſſertion ſeveral experiments he made, with a ſucceſs quite different from that with which Signor Redi made his.

The moſt that can be concluded from hence, I think, is this, that although the vipers in Italy do not differ in their nature from thoſe in France; yet there is a great deal of difference in the ſucceſs of the ſame experiments, when faithfully and judiciouſly made, and when they are cautiouſly and timorouſly managed, leſt they ſhould happen to overthrow a darling hypotheſis.

And therefore Monſieur du Verney in the Royal Academy, and Dr Areſkine, then at Paris, confirmed the opinion of Signor Redi, by ſeveral trials which they made with the ſame effect; as I was afterwards informed by the Doctor himſelf.

We reſolved to end our poiſon-inquiries by taſting the venomous liquor. Accordingly, having diluted a quantity of it with a very little warm water, ſeveral of us ventured to put ſome of it upon the tip of our tongues. We all agreed, that it taſted very ſharp and fiery, as if the tongue had been ſtruck through with ſomething ſcalding or burning. This ſenſation went not off in two or three hours: and one gentleman, who would not be ſatisfied without trying a large drop undiluted, found his tongue ſwelled with a little inflammation, and the ſoreneſs laſted two days. But neither his nor our boldneſs was attended with any ill conſequence.

This is no objection to the hurtful quality of this juice: for as ſome chemical liquors ferment with others of a certain kind only; ſo theſe poiſonous ſalts may affect one fluid of the body, and not another. Which that is, we ſhall ſhew anon. It is ſufficient to the preſent purpoſe to ſay, that the ſaline ſpicula are broken and diſſolved in the mouth by the clammy ſalival humour: and if any of them ſhould paſs thence into the ſtomach and inteſtines, the balſam of the bile will be an antidote there, powerful enough to overcome their force.

Theſe experiments upon the viper-poiſon and the blood, are a ſufficient confirmation of what has been advanced in the introduction, that the nervous liquor only is affected by this venom; and at the ſame time afford a convincing proof, how much thoſe ſcanty principles of our chemiſts, acid and alkali, fall ſhort in explaining the actions of natural bodies: ſince neither of theſe ſalts could in any way be found to affect the viperine venom.

Before I proceed, I muſt take notice, that even ſome of the ancients were thus far rightly appriſed of the nature of this poiſon. Of this Galen gives us teſtimony in ſeveral places; particularly in his book De temperamentis *, where he takes notice,

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* Lib. iii. cap. 2.

that "nothing has the ſame power upon the human "body outwardly as inwardly. Thus," (ſays he), "neither the venom of the viper, nor of the aſp, "nor frothy ſpittle of the mad dog, are alike miſ-"chievous when they fall upon the ſkin, or enter "into the ſtomach, as when outwardly communi-"cated by a wound."

And therefore Lucan (who being an hiſtorical poet, makes amends for what is wanting of invention, by the ſpirit and judgment always ſhewn in his deſcriptions) introduces brave Cato, when marching the remains of Pompey's army through Africa, very wiſely telling the ſoldiers, almoſt choked with thirſt, yet afraid to drink of a ſpring they came to, becauſe full of ſerpents *:

Noxia ſerpentum eſt admiſto ſanguine peſtis:
Morſu virus habent, et fatum dente minantur:
Pocula morte carent ——

Mix'd with the blood, the ſerpent's poiſon kills;
The bite conveys it; death lurks in the teeth:
Swallow'd it works no harm ——

In the like manner it was in thoſe times alſo known, that the virulent juice had the ſame bad effects, when mixed with the juices of the body, by means of a common wound, as when communicated by the venomous bite. This made Celſus † adviſe, in ſucking out the poiſon, to take care there be no ulcer in the mouth: though this caution be rather ſlighted and ridiculed by Severinus ‡ and others; who

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[*] Lucan. Pharſal. lib. ix. ver. 614. [†] Loc. ante citat. [‡] Vipera Pythia, p. 361.

who hereby diſcover how little they underſtood of the ſeat and nature of this poiſon. And Galen * mentioning the ſtory of Cleopatra, relates from other authors, that ſhe killed herſelf by pouring the virus of an aſp into a wound made in her arm by her own teeth.

In ſhort, it is upon this foundation that Pliny † aſſures us, the Scythians poiſoned their arrows with the ſanies of vipers mixed with human blood. The way of doing it Ariſtotle ‡ has at large related: and the Tartars are ſaid to uſe the like trick to this day. After the ſame manner the Indians make uſe of the venom of the lizard, called *Gecco.* This creature they hang up by the tail, and by whipping exaſperate it till it diſcharge its virus, in which they tinge their darts: and a very ſlight wound with theſe weapons is ſpeedy death ‖.

A later author, in his deſcription of the cape of Good Hope ⸸, informs us, that the way by which the inhabitants there, called *Hottentots,* kill great wild beaſts, lions, tigers, elephants, &c. is this: They take the bladders of poiſon with their liquor out of the gums of that deadly kind of ſerpents, which the Portugueſe call *Cobras de Capello:* theſe they dry in the ſun, and grind them to powder betwixt two ſtones: this powder they make into a paſte with the ſpittle or ſlabber of the ſame creature: which paſte they rub

* De Theriac. ad Piſon. lib. i. c. 1. Vid. etiam c. 10.

† Nat. Hiſt. lib. xi. c. 53. Scythæ ſagittas tingunt viperina ſanie et humano ſanguine: irremediabile id ſcelus.

‡ De mirabilibus.

‖ Bont. Hiſtor. Ind. lib. 5. c. 5.

⸸ Peter Kolben, printed at Norimberg, in High Dutch, 1719, pag. 532.

upon the points of their darts, and lay them by to dry for their uſe,

Having in the introduction explained in general the manner in which this poiſon, in common with all others of the animal kind, acts upon the body; I ſhall only here add the reaſon of one particular effect of it, which is thought very extraordinary and ſurpriſing, that is, the jaundice.

The jaundice is a ſuffuſion of bile upon the ſurface of the body, and indeed upon all the inward membranes alſo. The bile is a natural ſapo, that is, a mixture of oil, water, and a ſalt both volatile and fixed, ſeparated in the liver. That the ſecretion of it may be rightly performed, it is requiſite (as in all animal ſecretions) that there be a due proportion of its ſeveral parts, and alſo that there be a right diſpoſition of the ſecretory veſſels. Theſe compounding parts cannot be ſuppoſed to be altered in ſo ſhort a time as is here mentioned: but a conſtriction, or nervous ſpaſms, may almoſt ſuddenly ſo ſtraiten the orifices of the ducts, into which the bile is to paſs, that its derivation into them will be ſtopt; and conſequently it muſt remain in the blood, which in the courſe of circulation will diſcharge it upon the whole body.

This is a jaundice of the ſame kind with that which follows ſometimes upon violent colic pains, in which the ſpaſmodic contraction of the membranes of the abdomen interrupts the motion of the bile through the hepatic canals: the cure of which therefore is by plentiful dilution and anodyne medicines.

The caſe is quite otherwiſe in the common jaundice, which is a diſeaſe of the liver. In this the fault lies in the bile itſelf. For though it is uſually ſaid, that this is an obſtruction in the liver; yet it ought to be conſidered, that the veſſels are rarely obſtructed but by the diſorder of the liquors they carry; and conſequently that an ill ſtate of the bile muſt be, except in ſome extraordinary caſes, antecedent to an obſtruction in its ducts: and therefore, as the alterations of ſo compounded a fluid are different, ſo the jaundice is accordingly attended with different, nay ſometimes with contrary ſymptoms. In ſome caſes, without a fever, the fæces of the inteſtines are hard and white with great coſtiveneſs: in others a diarrhœa with a fever, and yellow diſcharges, weakens the patient. In the former (the conſequent generally of an inactive ſedentary life), for want of a due quantity of ſalt, the oily part of the bile grows viſcid and thick, and ſtagnates in the ducts of the liver: in the other (owing to plentiful living, and drinking ſpirituous liquors) the volatile part of the ſalt prevails too much, and the bile becomes too thin, hot, and irritating.

There is another diſeaſe, which though it be thought to belong to another part, yet is indeed ſo much akin to the jaundice, that it may be properly mentioned on this occaſion; I mean the diabetes. For this is not, as phyſicians have commonly judged, a diſtemper of the kidneys, but of the liver, proceeding likewiſe from a vitiated mixture of the bile. It happens moſt frequently to thoſe who without due exerciſe indulge themſelves in drinking vinous liquors, and then quench their thirſt ariſing from theſe, by too great a quantity of ſuch as are cooling. By ſuch ill-timed heating and cooling of the humours of the body, the natural proportion of ſalt in the bile, by which its oily part is incorporated with the water, is not ſufficient, now the water over-abounds, to preſerve the mixture: ſo that a great portion of this, together with ſome of the thinneſt of the oil, will be diſcharged by the kidneys; and the urinary ducts will be greatly enlarged by a conſtant afflux that way. By which means the thicker oily particles are left in a degree of coagulation in the ſmaller tubes of the liver, and are there formed into a hard fatty ſubſtance.

The diſſection of thoſe who have died of the diabetes, proves this to be ſo: for I have always found a ſteatomatous collection in their liver, in appearance not unlike to what is often diſcharged by ſtools in a confirmed jaundice, but of a harder conſiſtence.

As to the ſweetneſs of the urine, this is all bilious: for the water of the bile ſeparated from its ſalt is ſweet. Ox-gall, by a chemical diſtillation, yields four parts in five of water *. This I have obſerved to be fragrant, as if perfumed with muſk. The urine in the beginning of a jaundice very often ſmells like violets; and in a diabetes the flux is uſually leſſened towards the latter end of life, and the water is as bitter as gall: plain indications of a like origin of two diſtempers ſeemingly very different. Neither can I omit to take notice, that the cure of a diabetes confirms theſe remarks: for this is chiefly done by ſupplying the blood with a quantity of fixed ſalt, particularly ſuch as is contained in lime-water, and in that of the hot-well at Briſtol, which is indeed a natural lime-water. But what might be ſaid on this ſubject would

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* Vide Haller. Not. in Boerhaav. Inſtitut. Medic. § 99.

would require a juſt diſcourſe. It is time to come to the cure of the viper-poiſon.

There was formerly in Africa a nation of people called *Pſylli*, famous for the cure of the bite of ſerpents, with which that country above all others abounds. Theſe people were thought to have ſomething in their conſtitution ſo contrary to poiſon, that no venomous creature would touch them: and it was pretended, that they made this a trial of the legitimacy of their children. The truth of the matter is: They performed the cure in a manner very ſurpriſing to the vulgar, that is, by applying their mouth to the wound, and ſucking out the venom. The Marſi in Italy pretended to the ſame power *. Some ceremonies, to overawe the patient, and gain reverence to the operator, were added to the performance: but Celſus, the Latin Hippocrates, has wiſely obſerved, that "theſe Pſylli had no particular ſkill in this management, but boldneſs confirmed by uſe: for the poiſon of the ſerpent, as likewiſe ſome hunting poiſons, which the Gauls particularly make uſe of, are not hurtful in the mouth, but in a wound. Therefore whoſoever will, after their example, ſuck the wound, will be in no danger himſelf, and will ſave the life of the wounded perſon †." Ariſtotle has hinted ſomething to this purpoſe. "The

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* Vide Plin. Hiſt. Nat. lib. 7. c. 2. Ælian. Hiſt. animal. lib. 1. c. 57. et Lucan. lib. 9. ver. 891.

† Neque hercule ſcientiam præcipuam habent hi, qui Pſylli nominantur, ſed audaciam uſu ipſo confirmatam. Nam venenum ſerpentis, ut quædam etiam venatoria venena, quibus Galli præcipue utuntur, non guſtu, ſed in vulnere nocent. Ergo quiſquis, exemplum Pſylli ſecutus, id vulnus exſuxerit, et ipſe tutus erit, et tutum hominem præſtabit. Medicin. lib. 5. c 27.

" ſpittle of a man" (ſays he) " is an enemy to the bites " of moſt ſerpents *." And Nicander obſerves, " That ſerpents fly from even the ſmell of human " ſpittle †."

Pliny expreſſes the thing ſtill in a ſtronger manner, and affirms, " That there is in all men a poiſon " which kills ſerpents ; and that theſe creatures run " away from ſpittle, as they will from the touch of " ſcalding water ‡."

It may therefore juſtly ſeem ſtrange, that, upon ſo good an authority as that of Celſus, (who generally gives us the methods of the Greek phyſicians and ſurgeons), ſo beneficial and eaſy a practice as this of the Pſylli ſhould not have been perpetuated by phyſicians. But the notion, that a poiſon ſo fatal in a wound, could not be taken into the mouth, without hurt, was, no doubt, the obſtacle ; eſpecially when it was imagined, that outward applications would anſwer the purpoſe as well, without any hazard.

However, this method of cure ought, I think, to be revived : and there happened, about three years ago in London, a very remarkable caſe, which confirms the ſucceſs of it.

The ſtory is this, as related to me by an ingenious and experienced ſurgeon, who ſaw the caſe at the latter end of it. A man was bit on one of his fingers by a rattle-ſnake, juſt then brought over from Virginia. He immediately put his finger into his mouth, and ſucked the wound. His under-lip and tongue were preſently ſwelled to a great degree ; he faltered in

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* Hiſt. Animal. lib. 8 c. 29. † Πολλάκι ϗ βροτέων σιάλων ὑποέτρεσαν ὀδμήν. Theriac. ver. 86. ‡ Omnibus hominibus contra ſerpentes ineſt venenum, feruntque ictum ſalivæ, ut ferventis aquæ contactum, fugere. Loc. cit.

his ſpeech, and in ſome meaſure loſt his ſenſes. He then drank a large quantity of oil, and warm water upon it, by which he vomited plentifully. A live pigeon was cut in two, and applied to the finger. Two hours after this, the fleſh about the wound was cut out, and the part burnt with a hot iron, and the arm embrocated with warm oil. He then recovered his ſpeech and his ſenſes. His arm continued ſwelled the next day, but by common applications ſoon grew eaſy, and the patient ſuffered no farther miſchief.

As the poiſon of this ſnake is more quick and deadly than any other that we know, a remedy for this will moſt certainly prove effectual againſt that of ſmaller vipers, and all other creatures of this kind. The other applications here made uſe of (the vomit excepted) could be of no ſervice. The pigeon; the cutting and burning the part, two hours after the wound had been made, did no good. Embrocating the arm with oil only abated the ſwelling. Therefore the phyſicians of the royal academy at Paris gave a right judgment of this application, in a like caſe. An account having been given in our Philoſophical Tranſactions * of an experiment made, in which it was pretended that common oil, rubbed into the wound, had cured the bite of a viper; they with all poſſible care made ſeveral trials with it, and pronounced it to be ineffectual, any farther than as it might be a fomentation to the tumefied part †.

The firſt thing then to be done upon the bite of a viper of any kind, is, that the patient ſhould immediately ſuck the wound himſelf, if he can come at it: if he cannot, another perſon ſhould do this good of-

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* N° 443. † Mem. Acad. Sc. Par. an. 1737.

fice for him. Whoever does it, ought (to prevent any inflammation of the lips and tongue, from the heat of the poiſon) to waſh his mouth well beforehand with warm oil, and hold ſome of this in the mouth while the ſuction is performing.

After this is over, it will be proper to give a vomit. A doſe of Rad. Ipecacuan. encouraged in the working with oil and warm water, may be ſufficient. The good effect of this is owing to the ſhake which the action of vomiting gives to the nerves; whereby the irregular ſpaſms, into which their whole ſyſtem might be drawn, are prevented.

To confirm this practice, I have been aſſured by an ingenious ſurgeon, who lived in Virginia, that the Indians there cure the bite of the rattle-ſnake, by ſucking the wound, and taking immediately a large quantity of a decoction of the Seneca rattle-ſnake root, (which vomits plentifully), and laying to the part the ſame root chewed.

As to any other external management, I think it can avail but little; ſince it cannot prevent the ſudden communication of the poiſon to the nerves. Burning the part with a hot iron, is of no uſe. Dry ſalt upon the wound, recommended by Celſus *, promiſes ſomewhat more, but not much. The celebrated ſnake-ſtones, brought from the Eaſt-Indies, and ſaid to be taken out of the head of the Cobra de Capello, have no virtue to be depended on. This Signor Redi †, Monſieur Charas ‡, and myſelf have experienced. They will indeed, when applied, ſtick to the wound for ſome time; being, as appears from their

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* Lib. 5. c. 27. † Eſperienze intorno alle coſe naturali. ‡ Pag. 66.

make, not natural but factitious bodies, compounded moſt probably of calcined bones, and ſome teſtaceous ſubſtances mixed together: but when they drop off, they are found to have imbibed nothing of the venom.

More is to be ſaid for the remedy of our viper-catchers, in which they place ſo much confidence, as to be no more afraid of a bite than of a common puncture; immediately curing themſelves by the application of their ſpecific.

This, though they keep it as a great ſecret, I have however upon ſtrict inquiry found out to be no other than the axungia viperina preſently rubbed into the wound. And to convince myſelf of its good effects, I enraged a viper to bite a young dog in the noſe: both the teeth were ſtuck deep in; he howled bitterly, and the part began to ſwell: I diligently applied ſome of the axungia I had ready at hand, and he was very well the next day.

But becauſe ſome gentlemen, who ſaw this experiment, were apt to impute the cure rather to the dog's ſpittle*(he licking the wound), than to the virtue of the fat; we made him to be bit again in the tongue, forbearing the uſe of our remedy; and he died within four or five hours.

At another time I made the like trial with the ſame ſucceſs.

As this axungia conſiſts of clammy and viſcid parts, which are withal more penetrating and active than moſt oily ſubſtances; ſo theſe, without all doubt, may, if immediately applied, involve, and as it were ſheath, the volatile ſalts of the venomous liquor, and thus prevent their ſhooting out into thoſe cryſtalline ſpicula, which we have obſerved to be the main inſtruments of that deadly miſchief that attends the bite.

But even this cure ought not to be relied on. It is ſafeſt to uſe the method we have mentioned: and moreover, if the patient feels any ſickneſs, faintneſs, or any of the nervous ſymptoms we have deſcribed; he muſt be put into bed, and a ſweat muſt be promoted by cordial medicines, particularly the confect. Ralegh. and the ſalt of vipers, or, in want of this, ſalt of hartſhorn, given in warm wine. I have often experienced the good effects of this proceeding: and after all the pretenſions of the cure by oil, in the caſe above related *, the man was really not recovered without theſe means.

I ſhall conclude with ſome hints concerning the uſe of the viper in phyſic; becauſe authors are very large in enumerating its virtues againſt many, and ſome of them, very obſtinate diſtempers.

One of the firſt whom we find in antiquity to have made uſe of the fleſh of this creature to medicinal purpoſes, was, I think, Antonius Muſa, the famous phyſician to Octavius Cæſar; of whom Pliny † tells us, "That when he met with incurable "ulcers, he ordered the eating of vipers, and by "this means they were quickly healed."

It is not improbable, that he might have learned this from the great Greek phyſician Craterus, mentioned often by Cicero in his epiſtles to Atticus; who, as Porphyrius ‡ relates, "very happily cured "a miſerable ſlave, whoſe ſkin in a ſtrange manner

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[*] Phil. Tranſact. N° 443.

[†] Lib. xxx. c. 13.

[‡] De abſtinent. ab animal. lib. i. p. 16.

“ fell off from his bones, by adviſing him to feed
“ upon vipers dreſſed after the manner of fiſh.”

Be this as it will, in Galen’s time the profitable qualities of the viper were very commonly known. He ſays, that they who are afflicted with the elephantiaſis, are wonderfully relieved by eating vipers, dreſſed like eels; and relates very remarkable ſtories of cures of this diſeaſe, performed by the viper-wine *.

Aretæus, who moſt probably lived about the ſame time with Galen, and of all the ancients has moſt accurately deſcribed the elephantiaſis, commends, as Craterus did, the eating of vipers inſtead of fiſh in the ſame diſeaſe †. And to this purpoſe I remember, that as Lopes ‡, in his relation of the kingdom of Congo in Africa, takes notice how greedily the negroes eat adders, roaſting them, and eſteeming them as the moſt delicious food; ſo Dampier ‖ alſo informs us, that the natives of Tonquin in the Eaſt Indies treat their friends with arack, in which ſnakes and ſcorpions have been infuſed, accounting this not only a great cordial, but alſo an antidote againſt the leproſy, and all other ſorts of poiſon.

I have ſince been told by a learned phyſician, who reſided many years at Bengal, that it is a conſtant practice there to order in diet the Cobra de Capello (the viper of that country) to perſons waſted by long diſtempers.

The phyſicians in Italy and France very commonly preſcribe the broth and gelly of vipers fleſh for much

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* De arte curat. ad Glauc. lib. ii. c. 10. & De ſimpl. medic. facult. lib. xi. c. 1. † Curat. diuturn. lib. ii. c. 13. ‡ Vid. Purchas’s pilgrims, part 2. book vii. chap. 4. § 3. ‖ Voyages, vol. 2. part 1. p. 53.

the ſame uſes, that is, to invigorate and purify the maſs of blood exhauſted with diſeaſes, or tainted with ſome vitious and obſtinate ferment.

From all this it appears, that the main efficacy of the viperine fleſh is to quicken the circle of the blood, promote its due mixture, and by this means cleanſe and ſcour the glands of thoſe ſtagnating juices, which turning to acidity, are the origin of many, at leaſt, of thoſe troubleſome diſtempers in the ſurface of the body, which go under the names of ſcrophulous, leprous, &c.

Theſe good effects are owing to that penetrating, ſtrong ſalt, with which the ſubſtance of theſe creatures does, in a very great proportion, abound; and the reaſon of this is from the food they live on, which we have obſerved before to be lizards, moles, &c. whoſe nature every one knows to be ſuch as muſt neceſſarily, when they are diſſolved in the ſtomach, ſupply the blood with a great quantity of active and volatile parts. And herein lies the difference between the fleſh of vipers and that of other innocent ſerpents, which feeding chiefly upon graſs, herbs, &c. do not recommend themſelves to us by any of thoſe properties, which are in ſo eminent a degree found in the former.

Whoſoever reflects on what has been ſaid on this head, will very readily acknowledge, that our phyſicians deal too cautiouſly or ſparingly with a remedy, which may be applied to very good purpoſes, when they preſcribe a few grains of the powder of dried vipers, or make up a ſmall quantity of their fleſh into troches. Whereas, that ſervice may really be done this way, the patient ought to eat frequently of viper gelly, or broth; or rather, as the ancient manner was, to boil vipers, and eat them like fiſh; or if this food will not go down, (though really very good and delicious fare), to make uſe at leaſt of wine, in which dried vipers have been digeſted ſix or ſeven days, in a gentle heat *, from which I have ſeen very good effects in obſtinate lepras; or laſtly, (in ſome caſes eſpecially, where wine is not convenient), to take either the powder, or good quantities of the viperine ſalt, in which alone the virtue of all medicines made from this creature reſides. And therefore the ſalt of any other animal, which is ſtill more pungent and ſtimulating than this, (as is particularly that of Cantharides), is yet a more powerful remedy in dry and ſcaly leprous eruptions; which may without any inconvenience be given in the form of a tincture made with ſpirit of wine †.

AN APPENDIX,

Containing an anatomical deſcription of thoſe parts in a viper, and in a rattle-ſnake, which are concerned in their poiſon:

With a ſhort account of ſome other venomous animals.

IN order to give a full view of the inſtruments of death in a viper, and that larger ſpecies of it, the rattle-ſnake, I ſhall explain the figures drawn from diſſections of them both, beginning with the leſſer animal,

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* Vid. Pharmacop. Lond.

† Vid. eand. Pharmacop.

nimal, and ending with the bigger. And if ſome things are repeated in the latter, which had been obſerved in the former, this will not be thought tedious: becauſe, in ſubjects ſo minute, it is ſometimes neceſſary to repreſent the ſame parts in different ſituations and connections, that the uſes aſſigned to them may be the more clearly underſtood. And for this reaſon, I ſhall not follow the order of the figures, ſo much as I ſhall the thread of the deſcription which they are deſigned to explain.

TABLE I.

Exhibits ſeveral views taken from the head of the common viper.

Fig. 1. ſhews a ſide-view of the ſcull and jaws: in which

a. Repreſents two poiſoning fangs on each ſide, fixed (in a manner to be deſcribed hereafter) in a ſolid bone on each ſide *b*. Theſe ſolid bones are articulated by a ginglymus, as it were pendent to the two zygomata: upon which, with the poiſoning fangs, they receive two motions; viz. production, by which the fangs are erected; and retraction, by which theſe fangs are brought in, and couched againſt the roof of the mouth, ſo as to admit of cloſing the jaws.

Fig. 5. *a*. ſhews theſe fangs magnified.

Theſe motions are produced by a thin ſlip of bone, fig. 1. *c*. and fig. 5. *d*. which being connected to the bone *b*. below its articulation, makes it to join in the motions of production and retraction, which it receives itſelf, by being connected to the bone, fig. 5.

c. which is produced and retracted as well in conjunction with the under jaw, to which it is connected, as by the action of muſcles properly formed and ſubſervient to itſelf.

Fig. 1. *f.* ſhews the under jaw, and

d. e. its two fulcra, by the help of which it receives variety of motions neceſſary in ſwallowing its prey.

Fig. 6. ſhews theſe two fulcra *a* and *b*, by the intervention of which the under jaw is connected to the ſinciput and temporal bone.

In order to underſtand the manner by which the viper ſwallows its prey, it muſt be obſerved, that the upper and lower jaw on one ſide move independently of the upper and lower jaw on the oppoſite ſide; ſo as that the upper and lower on one ſide can be protruded or retracted, while the correſpondent parts on the oppoſite ſide are either employed in contrary motions, or held firm and unmoved; and being furniſhed with ſmall teeth firmly connected to their ſurfaces, which from their office we may term holders, fig. 1. *g.* and fig. 5. *c.* they are capable of drawing down their prey, by alternately retracting the two jaws on each ſide.

Theſe holders are more numerous in the upper, than in the lower jaw.

Fig. 5. *c.* ſhews them in the upper jaw.

Fig. 6. *d.* ſhews them in the lower.

Fig. 4. ſhews the top of the ſcull: in which

a. The ſinciput is compoſed of one bone, which in man is formed by the concurrence of the two parietal bones: whereas the frons *b*, which in man is one bone, is in this animal divided into two by a ſuture.

c.

c. Shews the anterior edges of the orbit of the eye formed by the frontal bone.

d. The oſſa naſi.

e. The maxillary bone in this animal no way divided.

Before we leave the bones of this part, we muſt obſerve, that the poiſoning fangs are different from the holders in other circumſtances, beſides their magnitude and motions. And firſt I muſt remark, that though there are two poiſoning fangs on each ſide, yet it rarely happens, that they are both firmly fixed in the ſockets deſigned for their reception. I have obſerved ſometimes, that the external fang on each ſide was looſe, and ſometimes the internal fang on each ſide was looſe; and ſometimes the internal on one ſide, and the external on the other ſide were looſe: and that, in protruding the fangs, that which was firmly fixed, was more erected than that which was looſe; which it likewiſe always exceeded in length. From all theſe conſiderations, joined to ſome circumſtances hereafter to be explained, I have been induced to believe, that the viper employs but one fang at a time; nature having ſo contrived, that the whole poiſon prepared on one ſide ſhall as effectually be lodged in the prey by the action of one fang, as by both, and thus be ſufficient to anſwer its purpoſe.

As the fang of the viper deſcribes an arch of a circle in wounding its prey, ſo its force and ſtrength are greatly ſecured by its curve form, reſembling nearly the claw of a bird, fig. 1. *a*, and fig. 5. *a*. But as this form is neceſſarily attended with a great difficulty in diſengaging it again from the part into which it is ſtruck; it muſt often happen, that its prey, in ſpringing away on being wounded, muſt break off the fang: and the rather becauſe the viper, finding itſelf pulled away by the motions of its prey, will probably laſh about its tail; till, fixing itſelf by it, the fang is obliged either to diſengage itſelf, or to break off ſhort at the ſocket, which is its weakeſt part. To remedy this inconvenience, the fang, which before was looſe, probably ſoon becomes fixed; and the broken fang falling out, another new one is fixed (though looſely) in its place. For, to ſupply this loſs or breaking of fangs, we always find a cluſter of young fangs of different degrees of perfection, lodged in the bag near the roots of the poiſoning fangs: of which I have counted ſix on one ſide in a rattle-ſnake. I ſhall not attempt to conjecture, by what means theſe ſubſidiary fangs are from time to time conducted to the empty ſockets; the ſeveral circumſtances mentioned being ſufficient to incline us to believe, that they ſerve for that purpoſe; as the life of the animal manifeſtly requires ſuch a ſupply for its preſervation.

Theſe poiſoning fangs are hollow from near the edge of the ſocket to near the point. This hollow begins by an orifice in the forepart of the tooth, fig. 2. *a.* and terminates at ſome diſtance above the apex *b*; from whence the fang is exceeding hard and ſolid, and ſloped off, ſo as to reſemble in ſome meaſure the common tooth-pick.

Fig. 3. repreſents this hollow of the tooth, by ſplitting it through its axis.

The apparatus for preparing and injecting the poiſonous fluid conſiſts in a gland, fig. 9. *c.* ſituated on each cheek: in which ſituation it is firmly connected to the ſinciput at its commiſſure with the occiput by the ligament *a*, and to the poſterior extremity of the lower jaw by the ligament *b*. From theſe ligaments continued on its ſurface the gland is furniſhed with a ſtrong albugineous coat, proper to ſtrengthen it againſt the great diſtenſions which it muſt ſuffer in accumulating its fluid, and the violent compreſſions in emitting it.

The ſame integument continued on forms the excretory duct *e*, by which the poiſon is conveyed from the gland into the cavity of the erected fang, by the aſſiſtance of a bag or purſe, fig. 7. and 8. *a*. in which the two poiſoning fangs are on each ſide contained.

f. Shews a ſmall white gland, which, from its ſituation near the fangs, has been ſuppoſed to be the organ for ſecreting the poiſon: though probably it is no more than either a lymphatic or a ſalival gland; and is entirely wanting in the rattle-ſnake.

All the muſcles ſubſervient to the action of biting are in this animal ſo ſituated, as to bear ſtrongly upon the poiſon-gland during their action; thereby conſpiring to ejaculate its fluid.

But the chief part in this ejaculation of the poiſon is performed by the muſcle *d*, which ariſing from the inferior maxilla runs obliquely upwards under the poiſon-gland, till paſſing between the two ligaments *a* and *b*, it reflects itſelf upon the external ſide of the gland, and running parallel with its length, is firmly attached to it. By the aſſiſtance of the ligament *a*, which in ſome meaſure ſerves as its tendon, this muſcle muſt contribute to cloſing the jaws: but its greateſt action is to ſqueeze the poiſon-gland, which it nearly ſurrounds; in the ſame manner as we uſually ſqueeze an orange, in order to expreſs its juice.

Tab. I.

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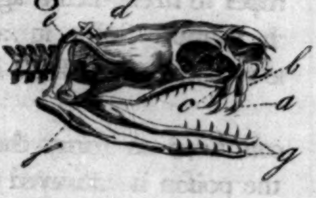
Fig. 1.



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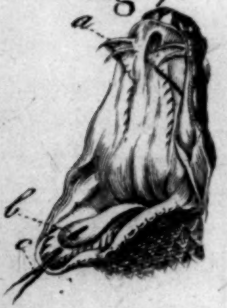

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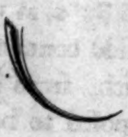

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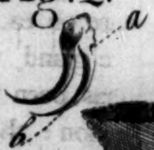

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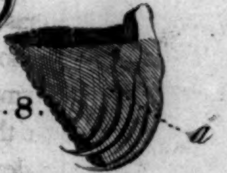

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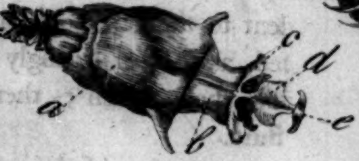

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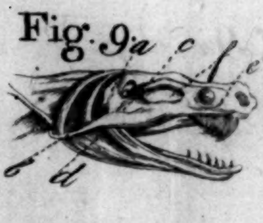

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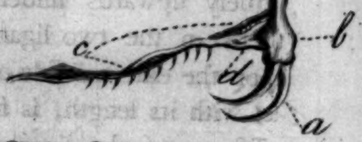

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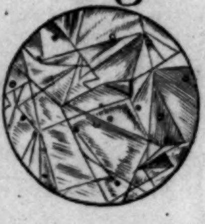
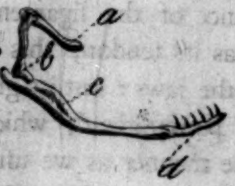


Fig. 6.



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The diſpoſition of this muſcle upon the ſurface of the gland in a continued courſe with the direction of its duct, and the terminating of this duct (which appears tendinous) at the roots of the fangs, were circumſtances, which raiſed an opinion, that this was altogether a muſcle ſubſervient to their retraction: the contrary of which will however appear by immerging the head, when excoriated, in hot water; after which the muſcle will eaſily ſeparate, and leave the gland naked to view.

Fig. 7. ſhews the head of the viper not diſſected: in which

a. Shews the two poiſoning fangs on each ſide incloſed in their proper bags, in which the different degrees of extenſion or erection are eaſily obſerved.

b. Shews the entrance into the trachea, ſo ſituated, as to be leaſt liable to being compreſſed in the action of ſwallowing.

c. Shews the tongue, by which the viper laps the dew; and by whoſe action poſſibly the ſubſidiary fangs are placed in the empty ſockets, as occaſion may require.

Fig. 8. repreſents the bag enveloping the two fangs, as it appears when conſiderably magnified; whereby the fimbriated or ſcalloped edge is more diſtinguiſhable. But the particular ſtructure and office of this bag will be better explained, by viewing it bigger in the rattle-ſnake.

TABLE II.

Shews five views taken from the head of an exceeding large rattle-ſnake: of which

Fig. 1. *a.* repreſents the maxillary bone.

b. The oſſa naſi.

c. The os ſphenœides.

d. The os ſincipitis.

e. The two oſſa frontis.

f. The os temporum, with the os auditûs like that of birds, but ſtanding nearly parallel to the ſpine.

g. The os occipitis.

h and *i.* The two fulcra of the inferior maxilla.

k. The bone, in whoſe ſockets the two poiſoning fangs are received, connected by a ginglymus to

l. The zygoma.

m, m. The moveable bone of the upper jaw furniſhed with its holders; in which bone a joint may be obſerved at fig. 2, *x.* at which joint it becomes curved, when

n. Fig. 1, a ſmaller ſplinter of bone, connected by one extremity to the former, and by the other to the bone containing the fangs, is ſo protruded, as to erect the fangs.

o. The poſterior extremity of the under jaw extended beyond its fulcrum, in order to increaſe the power of a ſmall muſcle ſerving to open it, fig. 2. *g.*

p. Shews a proceſs of the under jaw analogous to the corone in other animals, into which the great elevator is inſerted.

Below this proceſs externally may be obſerved a large foramen, *q*, by which the blood-veſſels and nerves enter: which, after ſupplying branches to the perioſteum and medullary ſubſtance, paſs out again at a large internal foramen, *w*. fig. 1. leaving ſome few twigs, which proceeding further paſs out at two ſmall foramina, *u*, and are ſpent upon the gums and under lip.

t, *t*. Shew the holders in each jaw, which do not appear to be connected by a gomphotic articulation, but fixed by ligaments into ſhallow pits or inequalities deſigned for their reception.

r. Shews the poiſoning fangs fixed in their ſockets, as they appear when almoſt fully erected. For a ſupply of theſe fangs, when accidentally broke out,

s. Shews ſeveral ſubſidiary teeth of different magnitudes in their natural ſituation.

Fig. 2. Shews the ſame head, with its poiſon-gland, and the ſeveral muſcles ſubſervient to the motions of the jaws, as they appear in their natural ſituation.

a. Shews a muſcle, which, by being inſerted behind its fulcrum, ſerves to open the under jaw.

b. A muſcle inſerted immediately before its fulcrum, ſerving to elevate or cloſe the jaw.

But the moſt active muſcle in cloſing the mouth and jaws ſeems to be *h*, *i*, which ariſing from the os ſincipitis, and paſſing down behind the poiſon-gland, is inſerted into the under jaw at ſuch a diſtance from its fulcrum, as to have the advantage of all the other muſcles.

d and *e*. Shew the two ligaments, by which the gland is fixed to the edge of the ſinciput and the extremity of the under jaw.

l. Shews the body of the poiſon-gland, covered by an albugineous coat formed by an expanſion of the two ligaments mentioned.

The ſame albugineous coat continued forms a large duct, *f*, by which the poiſonous fluid is conveyed from the gland to the bag *c*, which envelops the poiſoning fangs.

Now, although it has been obſerved, that the muſcles *b*, and *h*, *i*, are ſo ſituated as to bear againſt the gland during their action, thereby aſſiſting to expel the poiſon; yet the greateſt power in expelling the poiſon ſeems to be in the action of the muſcle *k*; which ariſing from the under jaw, and paſſing obliquely upwards behind, and in contact with the poiſon-gland, reflects itſelf forward between the two ligaments; and, after extending itſelf over almoſt the whole gland, is firmly implanted into its fore and lower part; ſerving thereby both to compreſs and contract the whole gland, and ſo to expel its fluid.

Fig. 3 gives a more diſtinct view of this gland ſurrounded by its proper muſcle.

a. Shews the poiſon-gland.

b and *c.* Its two ligaments.

d. Its duct.

e and *f.* The muſcle ſurrounding it, which ſerves both to cloſe the mouth in biting, or wounding its prey, and at the ſame time to expel the poiſon.

From this view it is obvious, why a leſs accurate examination (in ſo ſmall an animal as a viper, and whoſe muſcles, being white, are therefore leſs diſtinguiſhable from other ſubſtances) might lead inquirers into an opinion, that the whole together was a muſcle ſending off a round tendon, and ſerving to draw the fangs inward.

Fig. 4. repreſents an under view of the ſame head: in which

a. Shews the ſuperior orifice of the poiſoning fangs in their retracted ſtate.

b. Their inferior orifice.

c. Shews the fangs as covered by their bag, when in a retracted ſtate; which bag is cut open on the oppoſite ſide, in order to ſhew the fangs. And

d. A fimbriated ſeptum attached to the orifice of the poiſon-duct, and dividing the fangs from each other.

e. Shews the poiſon-gland, in whoſe duct two briſtles are placed, which, paſſing into the ſacculus at its ſummit, ſhew the entrance of the poiſon-duct *f*, exactly between the ſuperior orifices of the two fangs: through which orifices the briſtles entering the fangs paſs out at their ſlits.

Fig. 2. *c*. ſhews this bag, whoſe edge is fimbriated, when ſtretched and expanded during the erected ſtate of the fangs.

From this appearance it has been imagined, that the poiſon being diſcharged into the bag, and the bag being gradually preſſed up to the ſummit of the fangs by the ſides of the wound, as the fangs were impelled deeper and deeper, this preſſure of the bag, acting upon its contained fluid, would be ſufficient to force and direct the poiſon through the fangs into the bottom of the wound. But the loſs of the fluid, which would partly eſcape at the gutter neceſſarily made by the contact of two cones, and (if their contact be not very cloſe) between them too, with the waſte of ſome, which would be left in the bag, have induced me to believe, that the immiſſion of the poiſon

ſon into the wound depends on circumſtances very different.

I have been led to think, that, to leſſen the inconvenience of breaking the fangs, one fang only, and on one ſide only, is erected, at one bite, as I have before hinted; and that by being erected, its ſuperior orifice is brought nearly in contact with the orifice of the poiſon-duct: and that, as the poiſon-duct enters the bag exactly between the fangs, ſo the bag may ſerve to guide the duct to this or that ſide, according as this or that fang happens to be erected; thereby making the poiſon-duct and the hollow of the fang one continued tube or canal.

In order to this we need only to ſuppoſe, that the fimbriated ſeptum, which divides the two fangs, is more elaſtic, or yields more eaſily, than the ſides of the bag. In this caſe the fang by its erection ſtretching the bag, the ſeptum being weakeſt will follow this ſtretch; and its extremity, to which the orifice of the poiſon-duct is attached, be carried to this or that ſide, ſo as to meet this or that orifice, as the preſſure or erection may happen to be in this or that fang.

Fig. 5. ſhews

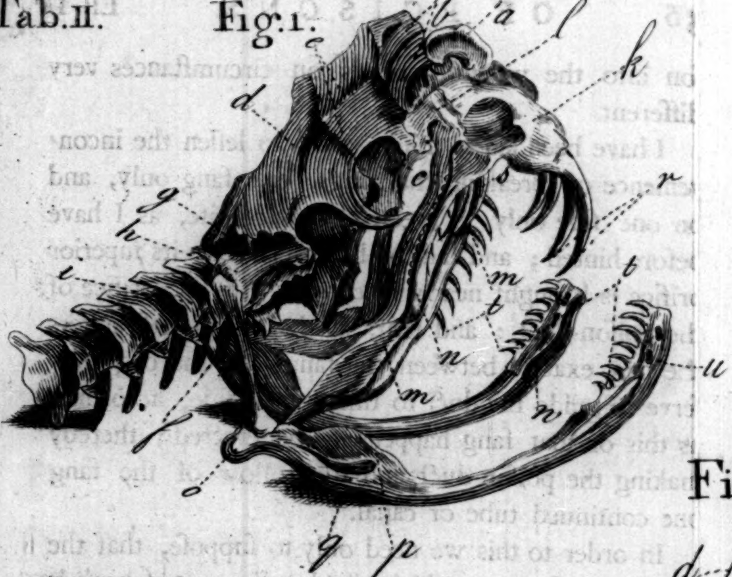
A. The part of the bag, which yields with the ſeptum to the preſſure of erection in the fang.

B, and C. The ſides of the bag, which admitting no ſtretch themſelves, may throw the whole motion on the ſeptum and the part A.

d, d. Two arches, of either of which any neceſſary part may be deſcribed by the motion of the orifice of the duct, in conſequence of the ſeptum's yielding more eaſily than the ſides of the bag. The orifice of

Tab. II.

Fig. 1.



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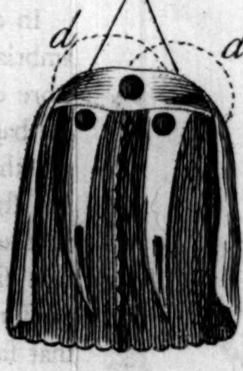

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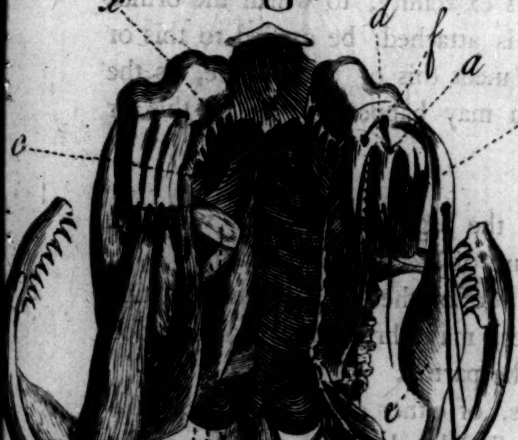

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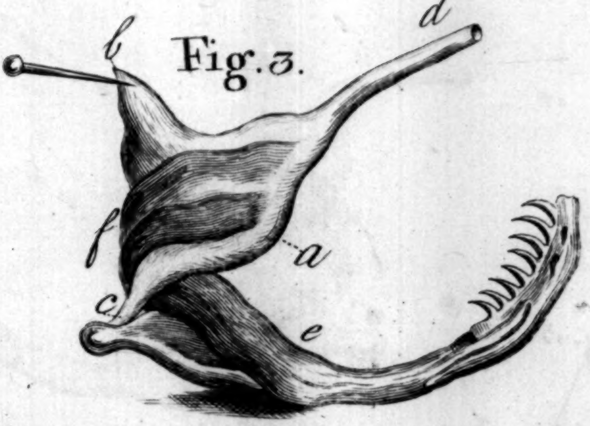

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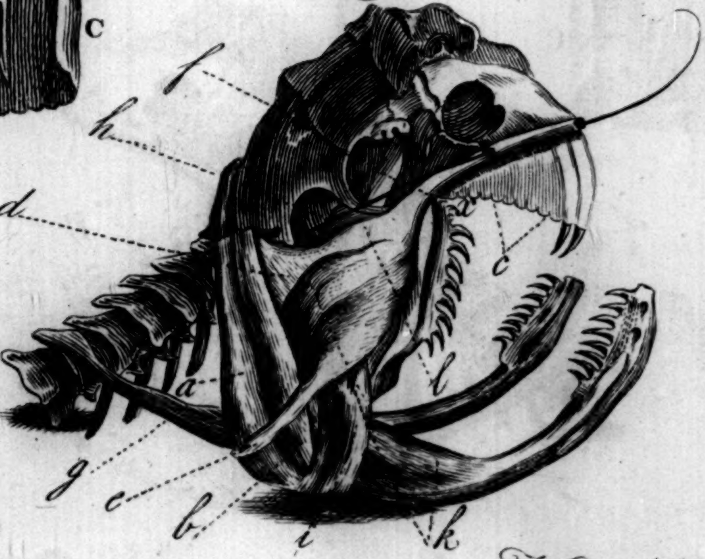
Fig. 2.



Thos. Phinn Sculp.

of the duct thus changing its ſituation may be applied to the orifice of either of the fangs occaſionally, and the whole poiſon prepared by the gland be employed in the action of one ſingle fang : the advantages of which to the viper itſelf have been already explained.

Fig. 4. *g*, *h*, *i*, *k*, *l.* Muſcles ſubſervient to the motions of the jaws, whoſe actions ſufficiently appear by their ſituations and directions.

To this moſt accurate deſcription by Dr Nicholls, I think it not amiſs to ſubjoin a remark, concerning the uſe of the rattle at the tail of this ſnake, which has its name from it ; becauſe a vulgar error has obtained, even among the learned, about it.

It is commonly ſaid, that this is a kind contrivance of divine providence, to give warning to paſſengers, by the noiſe which this part makes when the creature moves, to keep out of the way of its miſchief. Now, this is a miſtake. It is beyond all diſpute, that wiſdom and goodneſs ſhine forth in all the works of the creation : but the contrivance here is of another kind than is imagined.

All the parts of animals are made either for the preſervation of the individual, or for the propagation of its ſpecies : this before us is for the ſervice of the individual. This ſnake lives chiefly upon ſquirrels and birds, which a reptile can never catch without the advantage of ſome management to bring them within its reach. The way is this. The ſnake creeps to the foot of a tree, and by ſhaking his rattle, awakens the little creatures which are lodged in it : they are ſo frighted at the ſight of their enemy, who fixes his lively piercing eyes upon one or other of them, that they have no power to get away, but leap about from bough to bough, till they are quite tired; and at laſt falling to the ground, they are ſnapped into his mouth. This is by the people of the country called charming the ſquirrels and birds.

It muſt likewiſe be obſerved, that this ſnake does not make any noiſe with its rattle in the common motions of its body.

There is ſomething like this in the lion's hunting for his food. The hungry tyrant, by his terrible roaring in the woods, rouſes the leſſer beaſts out of their holes: they running about in fright and ſurpriſe, are eaſily ſeized, and become a prey to his devouring jaws.

And I have myſelf ſeen, upon a hawk's ſettling upon a tree in a garden, the little birds all about it ſo ſtruck with fear, that though they could fly backwards and forwards, for ſome little diſtance, yet they have not been able to get away from the ravenous deſtroyer.

POISONOUS ANIMALS.

AS the viper is hurtful by inſtilling a liquid poiſon into the wound made by its teeth; ſo likewiſe all venomous creatures whatſoever, whether they bite or ſting, though there be ſome difference in the contrivance of their organs, are miſchievous after much the ſame manner: and the moſt conſiderable of them for the ſame good uſe and purpoſe, that is, in order to kill their prey.

This will fully appear, by examining the inſtruments of death in ſeveral of them.

Firſt then, the ſpider, which lives upon flies, waſps, and the like inſects, is provided with a hooked forceps, placed juſt by the mouth, very ſharp and fine: with this he pierces the fleſh of little creatures caught in his web, and at the ſame time infuſes a juice into the puncture; by which means the animal being killed, he ſucks out the moiſture from the body, and leaves it a dry huſky carcaſe.

Mr Van Leeuwenhoek, in his account of ſpiders, publiſhed in the Philoſophical Tranſactions *, has, together with the other parts, by the help of his glaſſes, deſcribed theſe weapons; which he finds to lie couched on each ſide the mouth, in a row of teeth, till they are raiſed to do execution. Theſe rows of ſmall teeth are deſigned to hold the prey, that it may not eſcape the force of the bite. And in the convex part, towards the point of each claw, he has delineated a little aperture or ſlit, through which he ſuppoſes the poiſon iſſues out at the ſame time the wound is made.

This ſituation and motion of theſe parts I have ſeveral times viewed, but was never able to diſcern the outlet or opening; which, having a juſt deference to the induſtry and application of ſo nice an obſerver in things of this nature, I, at firſt, imputed to my own unſkilfulneſs in ſuch inquiries, knowing my microſcope to be very good: till at laſt, after repeated trials, I very plainly ſaw, that nothing dropt out of the claws, which were always dry while the ſpider bit; but that a ſhort white proboſcis was at the ſame time thruſt out of the mouth, which inſtilled a liquor into the wound.

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* N° 271.

Then I concluded, that Mr Leeuwenhoek had delineated the apertures in theſe weapons, only from the analogy which he thought they muſt bear to the viperine fangs, the ſting of the ſcorpion, bee, &c. And I was confirmed in this opinion by examining a claw of the great American ſpider, deſcribed by Piſo *, and called Nhamdu: which being above fifty times bigger than that of the largeſt European ſpider, if there had been any ſlit in it, my glaſs would, no doubt, have diſcovered it; but yet I found it to be quite ſolid.

And indeed the quantity of liquor emitted by our common ſpiders, when they kill their prey, is viſibly ſo great, and the wounding weapons ſo minute, that they could contain but a very inconſiderable portion thereof, if it were to be diſcharged that way.

To this purpoſe, I remember Mr Boyle ſomewhere tells a ſtory of a perſon blinded by a ſpider dropping its venom into his eye: which, though it can hardly find credit with ſome, is however confirmed by what Piſo relates of his Nhamdu, viz. that in catching it great heed is to be taken, leſt its poiſon fall into the eye, this cauſing a total loſs of the ſight.

What Mr Leeuwenhoek obſerves of the enmity theſe creatures bear to one another, I have often ſeen: for if four, five, or more be put together into a glaſs, they immediately fall to fighting with all the fury imaginable. Limbs ſtruck off are uſually the preludes to the terrible ſlaughter, which continues till all are killed, the ſurviving conqueror himſelf moſt commonly dying of his wounds.

The weapons of miſchief in the ſcolopendra or centipes, are ſomewhat different from thoſe in the ſpider.

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* Nat. Hiſt. lib. v. cap. 10.

ſpider. Having had one of theſe creatures ſent to me, preſerved in ſpirit of wine, from the Eaſt Indies, (where they are very large, and their bite is ſo painful, that, as Bontius ſays *, it makes the patient almoſt mad), I examined the claws of its forceps by a microſcope; and in each of them obſerved a ſmall aperture, on the upper ſide near the point †. And Mr Leeuwenhoek ‡, who had one of the ſame kind alive, found, that, by preſſing the claw, a ſmall drop of liquor iſſued out of this hole.

The caſe is much the ſame with ſtinging animals. Of theſe the ſcorpion ‖ is the chief, whoſe virus in different countries is more or leſs dangerous, according as it is exalted by various degrees of heat: thus in Africa particularly, its effects are ſo dreadful, that, as Joan. Leo ┼ tells us, the town of Peſcara there is in a manner left deſolate by the inhabitants in the ſummer time, by reaſon of the great abundance of theſe creatures; certain death following their ſting.

Several of this kind Signor Redi ⊹ at Florence had ſent to him from Tunis; and, it being November, he irritated them to ſting pigeons, pullets, &c. without any bad effect at all: but upon the approaching ſpring, one of them, which had been kept all the winter, nay eight months, without any food, and the wound of whoſe ſting before was harmleſs, ſtung to death two pigeons ſucceſſively; but a third and fourth wounded in like manner, ſuffered no hurt. Yet having let the ſcorpion reſt all night, he killed another pigeon the next morning.

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* Hiſt. nat. et med. Ind. Or. lib. v. cap. 4. † Vid. tab. iii. fig. 1. & 2. ‡ Continuatio arcanor. natur. epiſt. 124. ‖ Tab. iii. fig. 3. ┼ Hiſt. Afric. lib. vi. ⊹ Generazion degli Inſetti, pag. 15.

At the point of the ſting he very often could diſcern a ſmall drop of white liquor, which, when the wound was made, entered into the fleſh.

As this liquid venom is either not ſeparated from the blood into the cavity of the ſting, during the cold of winter, or at leaſt the ſcorpion wants ſtrength at that time to throw it out with force and energy; ſo even in the hot months, after it is exhauſted by two or three attacks, the ſting is no longer hurtful, till the expenſe of this juice is recruited by time.

Viewing the ſting of one of theſe animals brought from the Eaſt Indies, (where they are much bigger than in Africa), I could, with a glaſs, eaſily diſcover a long ſlit on each ſide of it, near to the cuſpis, which is exactly delineated by Mr Leeuwenhoek *, who alſo ſaw the venom drop out of it †.

It is very remarkable concerning this inſect, what an ingenious gentleman, who lived ſeveral years in Barbary, told me, he had many times tried; that if it be ſurrounded with a circle of burning coals, it does, upon the ſenſe of the heat, turn itſelf violently every way to make an eſcape; but finding it impoſſible, and the pain from the fire increaſing, it ſtrikes itſelf twice or thrice with the ſting on the back, and immediately dies of the wounds.

The fact has ſince been confirmed to me by others, who have aſſured me, that it is a common diverſion among the ſoldiers at Gibraltar, (where theſe creatures abound), to make this experiment.

This ſelf-murther decides the controverſy among writers, whether poiſonous animals of the ſame ſpecies can kill each other. Which is not only confirmed

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* Lib. citat. epiſt. 123. † Vid. tab. iii. fig. 4.

ed by what we before obſerved of the ſpider, but is likewiſe true of vipers: for Dr Herman bringing from the Indies three of the Cobras de Capello, all in one glaſs, two of them were killed in the voyage by fighting. And the learned Jo. Rhodius at Padua obſerved, that two ſcorpions being put into a glaſs, they fought, and one having killed the other, devoured it *.

As the viperine venom is the quinteſcence and moſt active part of thoſe animal juices with which the viper is nouriſhed; ſo is alſo that of the ſcorpion: for this inſect lives chiefly upon locuſts, &c. and the ſame perſon from Barbary informed me, that ſeeing oftentimes locuſts ſticking up in the ground, as if they were ſet there, by looking he found that ſome part of them was always eat away; and that theſe places were the holes of ſcorpions, who had dragged their prey thither, and fed on it as they had occaſion.

The mechaniſm of the ſting of a bee Dr Hooke has very accurately deſcribed †. One may with the naked eye ſometimes ſee it diſcharge the venom: and in this, by the help of a glaſs, I can eaſily diſcover a great number of minute ſalts floating.

And indeed this apparatus or contrivance is ſo univerſal, that we find even in vegetables ſomething analogous hereunto: for the laſt-mentioned author ‡ has ſhewn us, that the pricking points of nettles do, at the ſame time they pierce the ſkin, inſtil a venomous juice into the wound.

As the bites and ſtings not only of theſe inſects we have mentioned, but alſo of ſeveral others, as hornets,

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* Not. ad Scribon. Larg. p. 244. † Micrograph. obſerv. 34. ‡ Ibid. 25.

waſps, gnats, &c. are often very troubleſome, and attended with more pain, inflammation, and ſwelling, than would be expected from ſuch little enemies; I ſhall conclude with obſerving, that the common cure in all accidents of this kind, will be (as in the bite of a viper) by immediately ſucking out with the mouth the inſtilled poiſonous drop, and applying to the wound a poultice of bread and milk; but if this has been neglected, let the part be fomented with warm oil and ſoft diſcutient ointments.

ESSAY II.

OF THE TARANTULA.

THE ſymptoms from the bite of the tarantula are ſo very odd and ſurpriſing, that the truth of the facts has by ſome been called in queſtion. There is reaſon for this ſuſpicion, becauſe the miſchief commonly happens to poor people; who, as they often receive charity upon it, may be tempted to diſſemble, and to act a part, as if they ſuffered what they really have not. And beſides this, hyſterical affections (as we ſhall obſerve by and by) are in this country ſometimes attended with the ſame appearances: ſo that it is hard to diſtinguiſh one caſe from the other.

However, though there are here many deceits and impoſtures, yet even theſe, I think, are an evidence to prove the point; ſince it cannot be ſuppoſed, that a diſeaſe would be counterfeited, which had never any foundation in nature.

Neither can I be perſuaded, that Baglivi, a native of the country, and a learned phyſician, (who muſt have known that tricks were played in this way), would have taken the pains to write a long diſſertation on this ſubject *, had he not been thoroughly convinced of the reality of ſuch a poiſon.

Beſides this, after Baglivi's book was publiſhed, Ludovicus Valetta, a Celeſtine monk of Apulia, put out at Naples a treatiſe upon this ſpider †; in which he not only anſwers the objections of thoſe who deny the whole thing, but gives from his own knowledge ſeveral inſtances of perſons who had ſuffered this way: ſome of whom were of great families, and ſo far from being diſſemblers, that they would at any rate, to avoid ſhame, have concealed the misfortune which had befallen them.

To theſe may be added the teſtimony of the Honourable Mr Boyle, who aſſures us, that having himſelf had ſome doubts about this matter, he was, after ſtrict inquiry, convinced that the relations in the main were true ‡.

I ſhall therefore, from the authentic accounts given by the two mentioned authors, extract what is moſt material and neceſſary to our preſent purpoſe.

The tarantula ‖ is a ſpider of Apulia, of the octonocular kind; that is, of that ſpecies that has eight eyes, and ſpins webs. It has eight legs, four on each ſide, and in each leg three joints. From the mouth proceed two darts, in ſhape juſt like to a hooked forceps, or crab's claws: theſe are ſolid and very

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* Vid. Baglivi de praxi medica, & diſſertationes, Romæ, 1696. ‡ De phalangio Apulo opuſculum, Neapoli, 1706. ‡ Of languid and unheeded motions, chap. 6. ‖ Tab. iii. fig. 5.

ſharp, ſo that they can eaſily pierce the ſkin. And between theſe and the forelegs there are two little horns, which I ſuppoſe anſwer to thoſe bodies called from their uſe in flies the *feelers*; becauſe as they do, ſo this creature is obſerved to move them very briſkly, when it approaches to its prey.

This, as other ſpiders do, propagates its ſpecies by laying eggs, which are very numerous; ſo that there are found ſometimes in the female, when diſſected, a hundred or more; and theſe are hatched partly by the heat of the mother, partly by that of the ſun, in about twenty or thirty days time.

There is alſo a ſpider of the like nature with the tarantula in the Weſt Indies, which Fr. Hermandez * deſcribes by the name of *Hoitztocatl*, or the pricking ſpider; and ſays, that its bite induces madneſs.

In the ſummer-months, eſpecially when the heats are greateſt, as in the Dog-days, the tarantula creeping among the corn in the fields, bites the mowers and paſſengers: in the winter it lurks in holes, and is ſcarcely ſeen; and if it does bite then, it is not venomous, neither does it induce any ill ſymptoms.

But in the hot weather, although the pain of its bite is at firſt no greater than what is cauſed by the ſting of a bee; yet the part quickly after is diſcoloured with a livid, black, or yellowiſh circle, and raiſed to an inflamed ſwelling. The patient within a few hours is ſeized with a violent ſickneſs, difficulty of breathing, univerſal faintneſs, and ſometimes trembling, with a weakneſs of the head: being aſked what the ail is, he makes no reply, or with a querulous voice, and melancholy look, points to his breaſt, as if the heart was moſt affected.

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* Hiſt. animal. Nov. Hiſpan. tract. iv. cap. 5.

During this mournful ſcene, all the uſual alexipharmic and cordial medicines are of no ſervice: for, notwithſtanding their repeated uſe, the patient growing by degrees more melancholy, ſtupid, and ſtrangely timorous, in a ſhort time expires; unleſs muſic be called to his aſſiſtance, which alone, without the help of medicine, performs the cure.

For at the firſt ſound of the muſical inſtrument, although the ſick lie, as it were, in an apoplectic fit, they begin by degrees to move their hands and feet; till at laſt they get up, and fall to dancing with wonderful vigour, at firſt for three or four hours: then they are put to bed, refreſhed from their ſweating, for a ſhort time, and repeat the exerciſe with the ſame vehemence; perceiving no wearineſs or weakneſs from it, but profeſſing they grow ſtronger and nimbler, the more they dance.

At this ſport they uſually ſpend twelve hours a-day, and it continues three or four days; by which time they are generally freed from all their ſymptoms, which nevertheleſs attack them again about the ſame time the next year: and if they do not take care to prevent this relapſe by muſic, they fall into a jaundice, want of appetite, univerſal weakneſs, and ſuch like diſeaſes; which are every year increaſed, if dancing be neglected, till at laſt they prove incurable.

As muſic is the common cure, ſo they who are bitten, are pleaſed, ſome with one ſort of it, ſome with another. One is raiſed with a pipe, another with a timbrel; one with a harp, another with a fiddle; ſo that the muſicians make ſometimes ſeveral eſſays,

ſays, before they can accommodate their art to the venom: but this is conſtant and certain, notwithſtanding this variety, that they all require the quickeſt and briſkeſt tunes, and are never moved by a ſlow, dull harmony.

While the tarantati, or affected, are dancing, they loſe in a manner the uſe of all their ſenſes, like ſo many drunkards, do many ridiculous and fooliſh tricks, talk and act obſcenely and rudely; take great pleaſure in playing with vine leaves, with naked ſwords, red cloaths, and the like; and on the other hand can't bear the ſight of any thing black: ſo that if any byſtander happen to appear in that colour, he muſt immediately withdraw, otherwiſe they relapſe into their ſymptoms with as much violence as ever.

It may afford ſome light towards underſtanding the nature of this poiſon, to obſerve that Apulia is the hotteſt part of all Italy, lying eaſtward, and having all the ſummer long but very little rain to temper the heats: ſo that the inhabitants breathe an air, as it were, out of a fiery furnace. Hence their temperament is dry and aduſt, as appears by their being generally lean, paſſionate, impatient, ready to action, quick-witted, very ſubject to inflammatory diſtempers, phrenſies, melancholy, and the like: upon which account there are more mad people in this, than in all the other parts of Italy. Nay, what in other countries is but a light melancholy, ariſes here to a great height: for women in a chloroſis ſuffer almoſt the ſame ſymptoms as perſons poiſoned by the tarantula do, and are cured the ſame way; and in like manner the venom of the ſcorpion does here in its effects and cure agree very much with that of this ſpider.

From all this hiſtory it ſufficiently appears, that thoſe that are bitten by a tarantula, do thereupon become delirious. In order therefore to account for the ſymptoms they ſuffer, it may not be improper to ſay ſomething concerning a delirium.

Such is the conſtitution of the human œconomy, that as upon the impreſſion of outward objects made upon the organs, and by the fluid of the nerves conveyed to the common ſenſory, different ſpecies are excited there, and repreſented to the mind; ſo likewiſe upon this repreſentation, at the command of the mind, part of the ſame fluid is determined into the muſcles, and, together with the arterial blood there, performs all the variety of voluntary motions and actions.

This order has been always ſo conſtant in us, that at length by a kind of natural habitude, without the intervention of the reaſoning faculty, repreſentations made to the mind immediately and neceſſarily produce ſuitable motions in the bodily organs. When therefore theſe repreſentations are irregular, the actions conſequent to them muſt neceſſarily be ſo too.

This being premiſed, it may perhaps be probably ſaid, that a delirium is the repreſentation and various compoſition of ſeveral ſpecies to the mind, without any order or coherence; together, at leaſt moſt commonly, with irregular, or, as it were, undeſigned motions of the body: that is, ſuch a wandering and irregular motion of the nervous fluid, whereby ſeveral objects are repreſented to the mind, and upon this repreſentation divers operations performed by the body; though thoſe objects are not impreſſed upon the organs, nor thoſe operations or motions deliberately commanded by the ſoul.

The mind indeed is the firſt principle of all muſcular

cular motion: but in ſuch caſes as theſe, its promptitude to action or habit being ſo great, it is in a manner ſurpriſed, and cannot recover itſelf, after the ſpirits are with violent force determined purſuant to the repreſentation of the ſpecies. For as, in the former ſtate of things, a man is ſaid to act rationally, ſo this latter caſe is called a perturbation of mind, that is, a delirium; though it is very manifeſt, that in reality the defect is not in the rational, but corporeal part; ſuch ſpecies being really preſented to the mind, upon which, by the order of our conſtitution, ſuch motions ought to follow in the body.

Thus, for inſtance, if the liquor of the nerves is, without the preſence of any thing hurtful, put into a motion like unto that which a painful impreſſion makes in it; the ſame bodily actions muſt enſue, as proceed from fear, anger, or the like paſſion, determining the ſpirits towards the muſcular parts. And a by-ſtander, who ſees no reaſon for ſuch a repreſentation made to the mind, will preſently conclude, that the perſon thus acting acts without or beſide his reaſon, that is, is delirious; eſpecially if the hurry and confuſion of the ſpirits be ſuch, that not only one, but ſeveral different ſpecies be at the ſame time preſented to the mind: for a man in this caſe may act the part of one joyful, angry, timorous, or the like, without any appearing reaſon, and all this almoſt in the ſame moment of time.

In one word, deliria are the dreams of thoſe who are awake. And as theſe in us ſleeping are infinitely various and wonderfully compounded, and all from the ſame common cauſe, diverſely preſſing the orifices of the nerves, and thus making different repercuſſions of their fluid; and as we all know that, in this confuſion of repreſentations to the mind, there hereupon follow (though the body ſeem now in perfect repoſe) ſuch motions in the organs, as are uſually the effect of the arbitrary determination of the ſpirits thither: ſo we are now to inquire, what alteration of the body, made by this venom, can be the occaſion of this diſorder and tumult in the nervous fluid, which excites in the party infected, ſuch ſurpriſing, and almoſt contradictory repreſentations.

Moſt of the ſymptoms of thoſe who are bitten by the tarantula, are at the firſt, that is, before they riſe to a delirium, plainly the ſame with thoſe which the bite of a viper induces: without doubt therefore, as we have before obſerved of the common ſpider, that it pierces the fleſh with its hooked forceps, and at the ſame time inſtils from the proboſcis in the mouth a liquid venom into the wound; ſo the like claws in this * ſerve to make way for an active and penetrating juice emitted from the ſame part.

This fiery drop (as in the caſe of other poiſonous animals) puts the nervous liquor into a ferment: a fever enſues: the ſecretion of this fluid in the brain, and conſequently its derivation into the organs, is irregular: the impreſſions of outward objects upon the ſpirits ſo inflamed affect too ſenſibly; nay, without the action of theſe, in ſuch a diſturbed ſtate of the œconomy, ſpecies or images are preſented to the mind, which produce ſuitable, that is, irregular motions in the body.

More will be ſaid to this purpoſe in the following eſſay. For the preſent it may ſuffice to obſerve, that

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* Vid. tab. iii. fig. 5.

theſe repreſentations and actions will generally be according to the temperament of the patient; and the ſpirits will be hurried to thoſe parts, to which in time of health they have been moſt frequently determined: and every one knows which theſe are in hot countries and conſtitutions.

It will perhaps make this theory probable, to conſider that Baglivi *, in the diſſection of a rabbit, killed by a tarantula, found the ſubſtance of the brain, near the origin of the nerves, lightly inflamed, with livid ſpots here and there; a large quantity of extravaſated ſerum upon the brain: the effect generally of the circulation of the blood ſtopped by a fault in the ſecretion of the nervous liquor.

As to the cure, which ſeems almoſt ridiculous, we muſt take notice, that the patients have no inclination to dance, till they hear the muſic: being deſired to do it, they anſwer, it is impoſſible, they have no ſtrength. Their ſtarting up therefore, at the firſt noiſe of the inſtrument, is of a piece with their other actions: for as every thing from without has too great an effect on the nerves and their diſordered fluid; ſo ſounds, which formerly were joined to this exerciſe, and encouraged it, now excite to it with fury and violence. And the benefit of it is, that the continued motions of the limbs produce large ſweats, which, by carrying off the inflammatory particles, abate the fever raiſed in the animal ſpirits.

But, beſides this, we may perhaps allow ſomewhat to the determinate force and particular modulation of the trembling percuſſions of the air, made by the muſical chords upon the elaſtic fibres in the brain: for

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* Pag. 40.

contractile bodies may be acted upon by one certain degree of motion in the ambient fluid, though a greater degree of it, differently modified, may produce nothing of the like effect. This we ſee in the common experiment of two muſical inſtruments, tuned both to the ſame pitch: the ſtrings of the one being ſtruck, the correſpondent ſtrings of the other will ſound; and yet a much greater motion of the air, otherwiſe agitated, will not cauſe any ſenſible vibration in the ſame chords. And alſo by a trick which ſome have, of finding the tone or note peculiarly belonging to any large wine-glaſs, and by adapting their voice exactly to that tone, and making it loud and laſting, they will make the veſſel, firſt to tremble, and then burſt: which it will not do, if their voice be but a little either too low or too high *.

Mr Boyle relates a ſtory, from Scaliger, of a knight of Gaſcony, whom the ſound of a bagpipe would unavoidably force to make water; though this ſecretion is regularly made by the arbitrary contraction of the muſcle of the bladder †.

This makes it no difficult matter to conceive the reaſon, why different perſons infected with this venom, require often for their cure a different kind of muſic: their fibres having different tenſions, are not in like manner acted upon by the ſame vibrations.

The obſtinate continuing of the patients in this exerciſe is, in a great meaſure, owing to the encouragement of the by-ſtanders, and the ſtrong opinion they have of being benefited by it.

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* Vid. Morhoſii Stentor ΥΑΛΟΚΛΑΣΤΗΣ. Kilon. 1682. † Of languid and unheeded motions, chap. 6.

Nor are we to wonder at this practice, as odd and irrational: for muſic was anciently very much made uſe of to medicinal purpoſes; and may without doubt do very great ſervice, even by a mechanical force, in many bad diſtempers; particularly in ſome diſorders of the mind, which being always attended with irregular hurries of the ſpirits, may be quieted by exciting in them ſuch motions as accompany the contrary paſſions.

It is plain from the hiſtory of king Saul, that this was known in very early days among the Jews. He being at times ſeized with fits of madneſs, was cured this way *: for the evil ſpirit from the Lord, I ſuppoſe, (according to the Jewiſh manner of expreſſing extraordinary incidents), means no more than a maniacal fury, which by divine judgment he at certain times fell into.

We have a famous teſtimony to this purpoſe in Galen †, who tells us, "that Æſculapius uſed to "recover thoſe in whom violent motions of the "mind had induced a hot temperament of body, by "melody and ſongs." Pindar ‡ mentions the ſame thing: and indeed from hence not only the notion, but the very name of charming ‖ ſeems to have taken its origin.

Thus Athenæus relates, that Theophraſtus in his book of enthuſiaſm ſays, "Iſchiadic pains are cured, "if any one ſooth (or charm) the part by Phrygian "harmony ┼." And in the like alluſive ſenſe Cælius

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* 1 Sam. chap. 16. ‡ De ſanit. tuenda, lib. i. cap. 8.
‡ Pythior. od. 3. μαλακαῖς ἐπαιδαῖς. Vid. ibid. ſcholia.
‖ A carmine. ┼ Deipnoſoph. lib. xiv. p. 624.
Ἰσχιακοὺς φάσκων ἀνόσους διατελεῖν, εἰ καταυλήσοι τὶς τοῦ τόπου τῇ Φρυγιστὶ ἁρμονίᾳ.

Aurelianus calls this practice, *decantare loca dolentia;* and then adds by way of explication, that "the pain "is mitigated and diſcuſſed by the tremblings and "palpitations of the part *." Which ſeems very well to agree with what was before remarked, concerning the mechanical force of muſic upon the elaſtic fibres of the brain, whereby the ſpirits being determined to the parts affected, excite thoſe motions in them, which produce a cure. Beſides, as Athenæus here intimates, the Phrygian muſic was upon a pipe, which was the moſt vehement and briſk of all the ancients knew; ſo that indeed it was ſaid to raiſe thoſe who heard it, to perfect fury and madneſs †: and ſuch we have obſerved to be requiſite for the venom of the tarantula.

Aulus Gellius ‡ not only relates this ſame cure of iſchidiac ails as a thing notorious enough; but adds beſides out of Theophraſtus, "that the muſic of a "pipe rightly managed healed the bites of vipers."

And not only does Apollonius ‖ mention the cure of diſtractions of the mind, epilepſies, and ſeveral other diſtempers this ſame way; but Democritus ⫞ in his treatiſe of plagues taught, "that the muſic of "pipes was the medicine for many diſeaſes;" which Thales of Crete confirmed by his practice: for when ſent for by the Lacedæmonians to remove from them the peſtilence, he did it by the help of muſic ⊹.

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* Morb. chronic. lib. v. c. 1. Quæ cum ſaltum ſumerent palpitando, diſcuſſo dolore, miteſcerent.

† Vid Bartholin. de tibiis veter. lib. i. c. 9.

‡ Noct. Atticar. lib. iv. c. 13.

‖ Hiſt. mirabil.

⫞ Apud Aul. Gel. loc. citat. Plurimis hominum morbis medicinam fuiſſe incentiones tibiarum.

⊹ Plutarc. de muſica.

All which inſtances evince this remedy to have been very ancient in many caſes. And indeed, as Cælius Aurelianus * takes notice, that the firſt uſe of it was aſcribed to Pythagoras himſelf, ſo he having ſettled and founded his ſect in thoſe very parts of Italy, which are the country of the tarantula, going then under the name of Græcia Magna, now Calabria; it is not, I think, at all improbable, that he might have been the author and inventor of this practice there, which has continued ever ſince: eſpecially ſince Jamblichus affirms †, not only that he made uſe of muſic in phyſic, but particularly that he found out and contrived ſome harmonies to eaſe the paſſions of the mind, and others for the cure of bites.

To this uſeful power of muſic I will (to confirm my reaſonings upon it) add a remarkable inſtance of its hurtful effects, even in a brute; which an ingenious gentleman told me he once ſaw. A player on a fiddle having frequently obſerved, that a dog in the room was always ſo affected by a particular note, as to howl, and ſhew great uneaſineſs at it; one day, for experiment's ſake, continued to ſtrike the ſame note ſo long, till the ſenſible animal fell into convulſions and died.

To conclude with the tarantula, we may take notice, that, as to the return of the ſymptoms the next year, that is owing to the ſame exceſſive heat in thoſe months, acting again upon the ſmall remains of the venomous ferment. Thus Bartholin ‡ relates a ſtory of a melancholy phyſician at Venice, who ſuffered the

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* Loc. ante cit. † De vit. Pythagor. cap. 25. πρὸς δηγμοὺς βοηθητικώτατα μέλη. ‡ Hiſtor. anatom. cent. 2. H. 16.

attacks of his diſeaſe only during the Dog-days, which yearly ended and returned with them: a convincing proof how great a ſhare heat has in all theſe caſes.

ESSAY III.

OF THE MAD DOG.

THE terrible effects of the poiſon from the bite of a mad dog, appear after ſo different a manner in different ſubjects, that the accounts given of them by authors, being generally taken from ſingle caſes, are very different, and hardly conſiſtent with one another. The main ſymptom indeed they all agree in, is what they call (though improperly) the *hydrophobia*, or dread of water: but the diſorders with which this is attended, are related ſo variouſly, that they can ſcarcely be thought to belong to the ſame kind of malady.

I ſhall therefore firſt deſcribe the hiſtory of this diſeaſe, from obſervations made on a conſiderable number of patients; and then inquire into the reaſons, why the fatal diſtemper commonly produced by it ſhews itſelf with ſo much variety, and appears, as it were, diſguiſed in ſome caſes.

The wound from the bite of a mad dog differs not at all from that made by a common bite, and is as eaſily healed: and it is uſually a conſiderable time before any bad conſequences of it appear. There are inſtances where theſe have been deferred to three, four, or ſix months; nay, ſome authors ſay, to a year and longer. Galen himſelf ſaw one caſe after a year *; I remember one after eleven months: but the attack is generally within thirty or forty days, though very often ſooner, ſometimes in fifteen or ſixteen days, in young ſubjects.

The firſt approaches of the diſtemper generally diſcover themſelves after this manner. A pain is felt in the part which was wounded, which by degrees ſpreads itſelf to the neighbouring parts: a laſſitude follows with uneaſineſs in all the limbs. Then the patient grows penſive and ſad, with diſturbed and unquiet ſleeps, complains of faintneſs and lowneſs of ſpirits, particularly of an oppreſſion at his breaſt. His pulſe intermits, his nerves tremble, he has cold ſweats, a great nauſea and ſickneſs at ſtomach, and loaths food: and though he has an inward heat and thirſt, and deſires to drink; yet he ſwallows meat, but eſpecially liquors, with great difficulty. Theſe ſymptoms increaſe; and the next day, from the great uneaſineſs and pain which he finds in ſwallowing, he conceives ſuch an averſion to liquids, that at the firſt ſight of them he falls into convulſions and agonies, and cannot get down the leaſt drop. This hydrophobia has always been accounted the ſureſt ſign and mark of this poiſon, by which it is diſtinguiſhed from all other diſeaſes; as not being obſerved, at leaſt very rarely, in any other caſe whatſoever.

At this time a fever uſually appears, with a quick but low pulſe, without the leaſt ſleep, a hoarſe voice, a gathering of froth in the mouth, and ſpitting out of this upon the by-ſtanders; univerſal convulſions, particularly about the throat, and in the muſculi erectores penis, whence a continued priapiſm is obſerved.

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* Comment. ii. in 1 Prorrhet. Hippocrat.

During this tragical ſcene, which always proves fatal in about two days, a delirium comes on, ſometimes with moſt terrible ſymptoms of rage and fury, and attempts of doing all poſſible miſchief even to the moſt beloved friends and relations; but more commonly without any furor, it is of the melancholy kind, and the wretch reſigns to death, and prepares for it, bids thoſe about him take care of themſelves, leſt he ſhould do them a miſchief; and begs that they would trouble him no more: and, his breath growing ſhorter and ſhorter, he expires in convulſive fits.

Many of the ancients have mentioned this diſeaſe, particularly Dioſcorides, Galen, Ætius, Ægineta; but none have deſcribed it ſo largely as Cælius Aurelianus *, who, from the writings of the Greek phyſicians, (chiefly Soranus, of the methodic ſect), has collected, and put into obſcure bad Latin, all the ſymptoms of it, with great pains and exactneſs. The names of the more modern authors on this ſubject may be ſeen collected by that diligent obſerver, Stalpart Vander Wiel †; to which may be added the learned Dr Leiſter ‡.

It will afford great light towards the knowledge of the nature of this abſtruſe diſeaſe, to remark ſome odd appearances in the progreſs of it; which, though with a little variety, diſcover themſelves in a greater or leſſer degree in all the unhappy patients.

It is common to them all, that they can ill bear the impreſſion of objects upon the ſenſes. All feeling is painful. The ſlighteſt touch or rubbing of the limbs hurts. The leaſt noiſe is offenſive: and the

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* De morbis acutis, lib. iii.

† Obſervat. rarior. cent. i. obſ. 100.

‡ Exercit. medicinal.

opening or ſhutting of a door affrights, as if the houſe was falling. The eyes ſo ill bear the light, that even the ſight of any thing white is intolerable. In like manner, the inward membranes are ſo tender, that they cannot ſuffer their natural ſenſation. The common coolneſs of freſh air is diſagreeable to the lungs: and the making of water gives uneaſineſs and grief in the urinary paſſages. The aſpect is diſmal, either frightful with tokens of rage and fury, or lamentable with marks of moaning and deſpair. There is no ſleep from the beginning of the fever to the end.

When the ſymptoms are maniacal, the ſtrength of the muſcles is prodigious; theſe acting indeed with a convulſive force ſo great, that I have ſeen a caſe, in which a man tied down in bed with ſtrong cords broke them all at once by one effort, and immediately died paralytic; as if all the fibres of the body had been overſtrained, and torn to pieces by their violent action.

As to the hydrophobia, the patient at firſt has no dread of water, nor any averſion to liquors. On the contrary, he ſees them with pleaſure: being thirſty he deſires drink; but then ſoon wonders, what ſhould be the reaſon, that he is not able to take it. He contrives ways to do it, by endeavouring to ſuck through a quill, &c. but ſoon cries out, It is impoſſible. When aſked why, he anſwers, It will not go down, it ſtrangles him, and begs to be excuſed trying any more.

In order to find out the cauſe of this train of dreadful events, we muſt take notice, that the rabies or madneſs in a dog is the effect of a violent fever; and therefore it is moſt common in exceſſive hot weather, though ſometimes intenſe cold may be the cauſe of it: that no dog ever ſweats; from whence it follows, that when his blood is in a ferment, it cannot, as in other creatures, diſcharge itſelf upon the ſurface of the body; and therefore muſt of neceſſity throw out a great many ſaline and active particles upon thoſe parts where there is the moſt conſtant and eaſy ſecretion: and ſuch, next to the miliary in the ſkin in us, are the ſalival glands. For this reaſon much more ſpittle is ſeparated in a dog, when mad, than at any other time, and that very frothy, or impregnated with hot ſubtile parts.

The looks of a dog in this condition diſcover a fever. He runs wildly forward panting, ſnaps at every one he meets; his tongue hangs out of his mouth with ſlabber; his eyes are heavy, full of tears; he takes no food nor drink. In diſſecting one who died mad, the forepart of the dura mater on the brain, about an inch above the eyebrows, was found inflamed, and even ulcerated, the ulcerations piercing through this membrane, and alſo the pia mater: and upon preſſure there iſſued out from the ſmall ulcers a thin matter tinged with blood.

Now, as we every day obſerve, that what is thrown out from liquors in a ferment, is capable of inducing the like motion in another liquor of the ſame kind, when duly mixed with it; ſo we may very well ſuppoſe in the preſent caſe, that the ſaliva, which is itſelf one of the moſt fermentative juices in nature, being turgid with fiery ſaline particles thrown into it out of the boiling blood, when it comes by means of a wound to be mixed with the nervous liquor in another animal, muſt neceſſarily put it into violent agitations, in the nature of a ferment, (as has been explained in the introduction): the conſequence of which will be, all the effects of an interrupted ſecretion in the brain, and diſturbed circulation of the blood, a fever with a delirium, convulſions, &c.

That this delirium is ſometimes maniacal, ſometimes melancholic, is owing to the different temperament and conſtitution of the patient, inclined more to paſſions of one kind or the other. As we ſee the effects of drunkenneſs are in one man good humour, mirth, and joy; in another, ill-nature, malice, and rage; in a third, a mixture of ridiculous and extravagant actions: and all from the ſame common cauſe, raiſing natural diſpoſitions to a higher pitch. And we muſt likewiſe obſerve, that the huntſmen diſtinguiſh in dogs themſelves two kinds of this diſeaſe, one of which they call the biting, the other the ſullen madneſs.

In ſhort, this diſtemper is a fever of that kind, in which the nervous fluid is more particularly affected, from the violent action of an extraneous fiery matter mixed with it. A delirium enſues, attended, according to the diſpoſition of the body, with ſymptoms either of fury or of deſpondency, and very often with a mixture of both. For we know that theſe are frequently changed, and ſucceed to each other: a mania being indeed uſually a heightened melancholy; that is, from great and continued lowneſs of ſpirits, apprehenſions of evil increaſe more and more, and the imagination is poſſeſſed with ſpecies of things moſt terrible and deſtructive: upon which the mind is neceſſarily determined to actions, which by the conſtant order of nature follow upon ſuch repreſentations. And we therefore find, that, even in common fevers, patients will ſometimes give warning of their growing furious; that is, of their perception of frightful images, which will of courſe unavoidably hurry the mind to outrageous efforts.

But the hydrophobia (though it is commonly thought to be ſo) is no part of this delirium; as will appear anon.

From the deſcription we have given, it may, I think, be concluded, that there is in all theſe caſes ſome degree of inflammation, with too great a tenſion and drineſs of the nervous membranes, and too much elaſticity and force in the fluid with which they are filled: that by this they have acquired a preternatural ſenſibility; ſo that the uſual impreſſions of outward objects, inſtead of an agreeable feeling, give pain and uneaſineſs; and inward images are ſo ſtrong and lively, that the mind is ſurpriſed, and determines the ſpirits into the muſcular organs with an irregular impetus.

As a proof of this, the diſſection of the dead bodies generally diſcover the veſſels in the brain diſtended; the ſinus longitudinalis full of fluid blood, not coagulated, as is uſual in moſt other diſeaſes of the head; the brain itſelf, and the ſpinal marrow, drier than ordinary; the pericardium without liquor; the lungs loaded; the arteries full of blood, very fluid, and hardly concreſcible in the open air: appearances all, which ſhew the animal ſpirits to have been principally affected.

The hydrophobia, we ſaid, is no part of the delirium. For the patients, being feveriſh and thirſty, do always deſire drink, as long as they can ſwallow it: at laſt they find they can neither eat nor drink, but drinking is the moſt difficult. Now, the reaſon is this. This fever is of the nervous or ſpaſmodic kind: all the nerves are drawn into cramps; particularly the muſcles employed in deglutition are convulſed, their action is loſt, and it is then impoſſible to get any thing down. To aſk one in this condition to drink, is to deſire him to choke himſelf: and when he has found this to be ſo, he dreads the ſight of liquors offered to him, as much as he would a knife preſented to his throat, and ſtrives to keep them from his mouth. Liquids in ſuch a ſtate are ſwallowed with more difficulty than ſolids; becauſe the inſtruments of deglutition (which are principally the back part of the tongue, the hinder part of the palate, and the upper part of the œſophagus) can more effectually embrace and act with their joint force upon ſolid, than upon liquid ſubſtances. And beſides this, the epiglottis (which muſt always be cloſely ſhut at this time) is more powerfully preſſed down by a ſolid, than by a liquid body. When therefore the united force of theſe parts is taken away by convulſions, ſome part of the liquids will ſlide down into the aſpera arteria: upon which a ſuffocation muſt immediately follow. This diſeaſe therefore ſhould have been called Δυσκατάποσις, a difficulty in ſwallowing; rather than Ὑδροφοβία, a dread of water.

It will ſerve both to illuſtrate and confirm this reaſoning, to take notice, that there are other diſtempers beſides this, (and all indeed of the nervous kind), in which the ſame frightful ſymptom is ſometimes obſerved. Authors * have remarked it in malignant fe-

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* Schenckius de venen. animal. Salmuth. obſerv. cent. ii. obſ. 52.

vers: and a common melancholy has been ſeen to end fatally in it *. I have known it, in the height of a violent hyſteric diſorder, to have continued for many hours, till the convulſive motions in the throat were quieted by proper medicines: and I remember a caſe, in which fits of a palpitation of the heart were attended with ſo great a degree of it, that it ſeemed not to differ from the true hydrophobia.

On the other hand, it has ſometimes happened, that this bite has been followed with all the other uſual ſymptoms, even to a fatal degree, and yet no hydrophobia has appeared. A learned phyſician has aſſured me, that in Shropſhire he ſaw three patients in one year, who, at the ordinary time of about thirty or forty days after the wound, all fell into ſuch nervous diſorders as have been deſcribed, a fever, delirium, oppreſſion of the breath, palpitation of the heart, ſpaſms, &c. and died on the third day: yet none of them, during this melancholy ſcene, had any difficulty of ſwallowing, or ſhewed any ſigns of a dread of liquids.

The hydrophobia therefore is only a local convulſion, which, when the univerſal feveriſh affection of the nervous ſyſtem is come to the height, is very ſeldom abſent: but though it be, the ſpaſms of all the other parts may prove mortal. And becauſe this fever of the ſpirits is rarely ſo violent in any caſes, except the bite of a mad dog, as to produce a difficulty of ſwallowing; this ſymptom has been thought to be peculiar to that poiſon.

Nothing ſeems more wonderful in this whole affair, than that the venom ſhould as it were lie latent in the

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* Ephemer. German. ann. 1687.

the body ſo long a time before it diſcovers itſelf. Now, if, as has been ſaid, the poiſonous ſaliva acts upon the nervous fluid in the manner of a ferment, it may well be conceived, that before this can have a ſenſible effect, it muſt make ſome alteration in the more ſolid fibres of the brain, by inducing perhaps that tenſion and drineſs of the membranes, which we have mentioned. This in different conſtitutions will be done in a different ſpace of time: nay it may ſo happen, that this ferment being weak, and the conſtitution ſtrong, no viſible miſchief may enſue, till ſome accidental alteration in the body unluckily gives it an additional force; as we obſerved in the caſe of the tarantula, how far external heat promotes the delirium.

And therefore, by parity of reaſon, the calamitous ſymptoms may ſometimes, by the concurrence of extraordinary circumſtances, be unexpectedly brought on in leſs time than any above mentioned.

We experience every day in common nervous diſtempers, that the return and violence of the fits depend very much upon the action of things both within and without. We may add to this, that in ſome diſeaſes, in which the blood itſelf is infected, and the ſolid parts, even the bones, corrupted, the poiſon ſeems to be hid a conſiderable time, while it is working in the body, before its laſt effect appears; as particularly in venereal caſes.

Neither will it ſeem ſtrange, that a poiſon ſo different in its force, and ſo alterable by many circumſtances, ſhould in ſome ſubjects produce ſymptoms of the ſame convulſive kind, yet not to ſuch a degree as to hinder deglutition; and theſe too only at particular times.

A ſoldier of a ſtrong habit of body came to me not long ſince, who once a-month was ſeized with a great anxiety, palpitation of the heart, and difficulty of breathing. He had been bitten by a mad dog about about ſix weeks before he began to complain. By bleeding, cold bathing, the powder of lichen with pepper, and volatile medicines during the oppreſſion, the fits were every month leſs violent, and at laſt quite left him.

A moſt remarkable caſe of this kind was communicated to me by a perſon of unqueſtioned veracity. It was this. A gentlewoman in Yorkſhire, of the age of thirty-five years, was bit by a mad dog in the fore-finger: about a month after, ſhe had a pain in that part, which ſhot up to the ſhoulder, and was thought to be rheumatic. This pain returned every month, juſt a day before the full moon, laſting generally three days. After fifteen months ſhe fell into the hydrophobia, and died the third day. Her friends then recollected the bite to have happened ſo long before.

The influence of the moon in theſe caſes I am convinced is of ſome weight. The manner of its action I have attempted to explain in another place *: and as the proofs there given are undeniable, and very much regard the nervous fluid; it cannot be doubted, but the ſame power may have the like effect in a diſeaſe in which this fluid ſuffers more remarkably perhaps than in any other whatſoever.

Looking over the hiſtories of the many patients I have attended in this deplorable condition, I obſerve about one half of the number to have been

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* De imperio ſolis ac lunæ.

attacked with the ſpaſms preceding the hydrophobia, either upon the full moon, or the day before it. And where this is only an influence concurring with inward cauſes of great force, it is not to be expected, but that thoſe ſhould often prevail without this external aſſiſtance.

But it is time to come to the cure, or rather the means of preventing the effects of this terrible poiſon. For all authors agree, that, after the appearance of the hydrophobia, the caſe is almoſt deſperate: and the reaſon is plain from the deſcription we have given of it, a diſmal ſcene of the laſt ſtruggles and agonies of nature yielding up to the enemy.

The firſt care to be taken is of the wounded part. The ancient phyſicians *, who are followed in this by the moderns †, adviſe, where the place will admit of it, to enlarge the wound by inciſion; to apply a cupping-glaſs; to burn it with a hot iron; and to keep a diſcharge from the ulcer by drawing medicines for many days.

I cannot but ſay that I think all this ſeverity needleſs. The deſign of it is to draw out the poiſon: but as it has been proved, that this immediately affects the nervous liquor, the miſchief muſt have taken place, before applications of this kind can be made.

I therefore am of opinion, (becauſe it may however be of ſome ſervice to have a continued drain from the part), that it will be ſufficient to enlarge the wound a little, and dreſs it with ung. baſilic. nig. adding to it a ſmall quantity of mercur. præcip. rub. as a digeſtive.

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[*] Vid. Galen. de ther. ad Piſ. l. i. c. 16. & Ætium, l. vi. c. 24. & Celſum, l. v. c. 27.

[†] Hildan. obſ. cent. i. obſ. 87.

It happens in moſt caſes, that the wound being ſmall, is healed up before the patient ſeeks for help. For this reaſon, and becauſe it is of no great conſequence whether it be cured or not, in the paper which I printed and diſperſed ſome years ſince, entitled, *A certain cure for the bite of a mad dog*, I took no notice of any outward application: the rather, becauſe I thought, if any great ſtreſs was laid upon it, it might frighten thoſe who had neglected this care, and lead them to think that the other part of the cure would not be effectual without it. And I can ſafely affirm, that (whether any outward application was made or not) I have never known this method to fail of ſucceſs, where it has been followed before the hydrophobia began; although, in the courſe of about thirty years, (beſides the experience made by others, both in town and country), I have uſed it a thouſand times. I have often wiſhed that I knew ſo certain a remedy in any other diſeaſe: I ſhall therefore give the reaſons of this method.

But before I proceed to the particulars of it, it may not be amiſs to mention the moſt conſiderable medicines which have been formerly uſed in this caſe: for it will hence appear, that the like intentions have been purſued in all times, though by different ways.

The injudicious jumbles of theriaca's, ſpecific antidotes, &c. whether old or new, deſerve no notice. That ridiculous preſervative, the liver of the mad dog, which Pliny ſays * ſhould be eaten rather raw than boiled, is neither good food nor phyſic. Galen † obſerved, that it availed nothing: and I remember to have ſeen a poor boy die mad, who had greedily devoured almoſt the whole of it.

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* Hiſt. nat. l. xxix. c. 5. † De ſimpl. med. facult. l. ii. c. 1.

There are two or three remedies recommended, I think, upon rational grounds. The firſt is the cineres cancrorum fluviatilium, aſhes of the river crawfiſh. Theſe were prepared by burning the fiſh alive upon a copper-plate, with a fire made of the cuttings of twigs of the white briony. This Galen * avers that no body ever made uſe of without ſucceſs: and before him Dioſcorides † aſſured, that it is a medicine which might be relied on. This calcined powder was given in large quantities, *viz.* a good ſpoonful or two every day for forty days together; either alone, or rather mixed with a ſmall portion of gentian root and frankincenſe.

Another medicine is the ſpongia cynorrhodi, vel roſæ ſylveſtris, the ſponge of the dog-roſe, which is ſo celebrated an antidote againſt this and other animal poiſons, that P. Boccone ‡, who has written a whole diſcourſe upon its virtues, tells us, it is called in Sicily, *ſanatodos*, or all-heal.

Beſides theſe, the plant alyſſum or madwort had its name given it by the ancients, from its great efficacy againſt this madneſs. This was of two ſorts, one deſcribed by Dioſcorides, a ſpecies of the leucoium, the other by Galen, a marrubium ‖. To theſe may be added, garlick, agrimony, and oxylapathum.

Now, it is remarkable, that all theſe remedies are powerful diuretics; the two firſt of the animal, the laſt of the vegetable kind. For, as Mr Ray * has obſerved, the ſponge of the cynorrhodon is an excreſcence formed upon the plant, as galls are upon the oak. If it be cut, it is found full of white worms, being the neſt of theſe inſects; which lodging here all the winter, do in the beginning of the ſpring turn to flies, and quit their quarters.

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* De ſimpl. med. facult. l. iii. c. 34.

† De theriac. c. 2.

‡ Muſeo di plante rare, obſ. 2.

‖ Vid. Fab. Column. Phytobaſan. p. 27.

All inſects abound with a diuretic ſalt; but as cantharides do ſo more than any others, therefore the learned Baccius † goes farther, and, from the authority of Rhazes and Joannes Damaſcenus, adviſes to give theſe in ſubſtance for many days together. The preparation of this antidote (ſo he calls it) is by infuſing the flies in ſour butter-milk twenty-four hours, then drying them, and with the flour of lentils and wine making them up into troches of a ſcruple weight, of which one is to be taken every day; by which means he aſſures us, that though the patient make bloody urine, yet that milk largely drank will abate that ſymptom, and that the hydrophobia will be happily prevented. Boccone likewiſe informs us, that in Upper Hungary they give in this caſe five cantharides in one doſe to men, and to beaſts a greater quantity ‡.

I muſt add, that Ætius ‖, who has collected all the medicines he could from the old phyſicians, affirms, that himſelf knew an old man, who cured thoſe who were bit, with common ſorrel only. He waſhed the wound with a decoction of this herb, and laid it on as a cataplaſm, and gave it in drink: by

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* Hiſt. plant. tom. ii. p. 1471.

† De venen. p. 89.

‡ Muſeo de fiſica, obſerv. 21.

‖ Lib. vi. c. 24.

this means, the patient made a great quantity of turbid urine.

From hence it apears, that the ſureſt remedies in all ages againſt this venom have been ſuch as provoke a great diſcharge by urine. Reflecting upon this, I thought it muſt be right to give to the public a courſe eaſily to be purſued, which by preventing the fever for a long time after the bite, and conſtantly promoting this evacuation, might ſecure the patient from danger. The method is this.

" Let the patient be blooded at the arm nine or
" ten ounces. Take of the herb, called in Latin
" *lichen cinereus terreſtris*, in Engliſh *aſh-coloured*
" *ground liverwort*, cleaned, dried, and powdered,
" half an ounce. Of black pepper powdered, two
" drachms. Mix theſe well together, and divide
" the powder into four doſes; one of which muſt be
" taken every morning, faſting, for four mornings
" ſucceſſively, in half a pint of cow's milk warm.
" After theſe four doſes are taken, the patient muſt
" go into the cold bath, or a cold ſpring, or river,
" every morning faſting, for a month: he muſt be
" dipt all over, but not ſtay in (with his head above
" water) longer than half a minute, if the water be
" very cold. After this he muſt go in three times
" a-week for a fortnight longer."

This powder was firſt publiſhed in the Philoſophical Tranſactions *, from Mr Dampier, in whoſe family it had been kept as a ſecret many years: and in the year 1721, it was, at my deſire, put into the Pharmacop. Lond. by the name of *pulvis antilyſſus*. I afterwards made this alteration only, of putting two

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[*] N° 237.

parts of lichen to one of pepper, inſtead of equal parts, becauſe I thought it too hot: and whereas but two or three doſes of it were formerly given, I repeated it four days.

The lichen, like thoſe already mentioned, is a warm diuretic; the pepper is added, I ſuppoſe, to make it more agreeable to the ſtomach: for it is diſtaſteful and nauſeous.

This plant * is ſo remarkable for its virtue, that it may not be amiſs to give a deſcription of it.

Mr Ray, ſo far as I can find, was the firſt who gave a diſtinct account of it †, reckoning it among the lichens. Our great botaniſt, Dr Dillenius, has lately more exactly deſcribed it ‡, and put it into the tribe of the moſſes, calling it *lichenoides digitatum cinereum, lactucæ foliis ſinuoſis*. It appears indeed to be of a ſubſtance between a fungus and a muſcus, ſoft, ſpongy, and lanuginous. It grows cloſe to the ground, chiefly on heaths, and in woody, ſhady places, near the roots and ſtumps of trees; which being commonly covered with creeping, moſſy herbs, it ſticks to them when it is gathered.

It is found in all countries, and from America has been obſerved to be brought over with the Peruvian bark.

The leaves when young are ſmall, but grow to two or three inches in length, and an inch or two in breadth, divided into ſeveral ſegments. They are ſometimes ſingle, ſometimes lying upon one another. At their extremities they produce little hard, oblong bodies, which the botaniſts call *peltæ*, and are undoubtedly the ſeminal capſulæ. The leaves, when dry, are aſh-coloured, darker on the upper part; on the under, lighter. Frequent veins are obſerved along them, from which here and there run ſmall white fibres into the earth, the roots of the plant.

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* Vid. tab. iv.

† Vid. Catal. plant. Angl. ann. 1670, & hiſt. plant.

‡ Hiſt. muſcorum, p. 200

It is found at all times of the year, eſpecially after rainy ſeaſons, that is, from autumn to winter: and therefore, as being in its freſheſt vigour, it ſhould always be gathered about that time.

I have alſo examined it by diſtillation; by which four ounces of it yielded, of an acid water, one ounce, five drachms, one ſcruple, and two grains; of oil heavier than water, two drachms, one ſcruple, ſixteen grains; of coal containing fixed ſalt, one ounce, two drachms, one ſcruple, eleven grains.

But I proceed in the cure. To make this more effectual, I added the uſe of cold bathing, which had never been recommended in this manner before. The ancients, as I ſhall obſerve preſently, never applied it till the hydrophobia appeared; and the common practice among us of ſending the patient to the neareſt ſalt water, as ſoon as may be, and there only to dip him all over twice or thrice, it is plain, cannot avail much to the prevention of a diſeaſe, which will not appear till about a month after; and therefore it ought to be continued for ſo long a time, if any advantage is to be expected from it: and I have indeed known many to have died raving, who had undergone this treatment. It is the preſſure of the water upon the ſurface of the body, and the conſtriction the cold makes upon the fibres of the ſkin and the ſmall tubes, which produce the good effect. The diſtenſion of the veſſels by the fermenting humours is hereby by repreſſed, and a flux of urine promoted for ſo many days, that all danger of the nervous fever, the conſequent of the inſtilled poiſon, is quite over. And if it ſhould be thought that ſalt water, being heavier than freſh, will preſs more; this difference, in two or three immerſions only, can be but of ſmall moment, and is abundantly compenſated by the greater coldneſs of ſprings (which are uſually choſen for this purpoſe) than is felt in the ſea.

Thus I have made plunging into water effectual in preventing this diſeaſe, without the danger of drowning: whereas the ancients practiſed the ſame to remove it when it appeared, with ſome degree at leaſt of this hazard. For Celſus *, who ſeems firſt to have mentioned it, and ſays it is the only remedy, adviſes, if the patient cannot ſwim, to let him be kept under water, that he may ſwallow it; and then at times be lifted out of it; if he can ſwim, to hold him under by force, that he may drink whether he will or not. This in ſhort is drowning and recovering by turns. And I make no queſtion, but ſo bold a practice was grounded on the authority of the Greek phyſicians, from whoſe rich ſtores this Latin author has extracted, and digeſted into a ſmall compaſs, the beſt ſyſtem that ever was compoſed of medicine.

However it be, the famous Van Helmont †, in the

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* Unicum remedium eſt, nec opinantem in piſcinam non ante ei proviſam projicere, et, ſi natandi ſcientiam non habet, modò merſum bibere pati, modò attollere; ſi habet, interdum deprimere, ut invitus quoque aqua ſatietur: ſic enim ſimul et ſitis, et aquæ metus tollitur. Lib. v. cap. 27.

† Ortus medicin. demens idea.

beginning of the laſt century, having obſerved the great effects of this practice in Flanders, recommended it in a very ſtrong manner. He ſaw an old man in the hydrophobia, cured by ſubmerſion in ſalt water. He was firſt held under the water about four minutes, then taken out, and dipped again twice more, each time about a minute. When he was taken out, he really thought him quite dead; but being kept warm, and laid over a barrel, he vomited up the water he had ſwallowed, and recovered both his life and right ſenſes.

He relates another remarkable ſtory of the cure of the common mania, by being drowned in freſh water; and from this rightly concludes, that it makes no difference in the caſe, whether the water be ſalt or freſh. He juſtly remarks, that great care ſhould be taken not to give over for dead thoſe who are drowned; adding two remarkable inſtances of perſons who were brought to life, after they had lain under water half an hour. And to this purpoſe I remember, that an ingenious phyſician told me, that he had; not long ſince, in the country, happened to ſave a man from the grave, who having been ſunk in a river more than twenty minutes, was judged to be paſt all hopes of recovery.

There are many accounts upon record of thoſe, who after having been drowned many hours have been brought to life *. This ſhould certainly encourage the uſe of all means upon ſuch accidents, eſpecially ſince the trial is not difficult. The firſt ſtep ſhould be, to blow up the ſmoke of tobacco into the inte-

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* Vid. diſſertation ſur l'incertitude des ſignes de la mort. Paris, 1742.

tines: then to warm the body by ſhaking and rolling it about, and rubbing it with warm cloaths in bed: in a word, to put the blood into motion by all manner of ways; and not to be diſcouraged, though no ſigns of life ſhould be diſcovered after an hour or two ſpent in this good work: towards the latter end of which volatile ſpirits and ſalts may have a good effect. Neither ſhould bleeding be omitted, when the blood is become warm enough to drop out of the veins.

But to return from this (I think uſeful) digreſſion to the hydrophobia, I muſt obſerve, that if ſubmerſion in this way be put in practice, it ought to be done upon the very firſt ſigns of the ſymptom, before the fever is come to its height. For when it is ſo, there will not be natural ſtrength to overcome the ſhock: and I have always found, that at this time even common bathing has proved hurtful.

But experiments of this kind are perhaps rather to be permitted than injoined by phyſicians, for their own ſakes; though it is certain, that cures more dangerous than this are every day directed: but that is generally in caſes, where it cannot ſo evidently be known, whether the patient dies by the remedy or by the diſeaſe. In ſuch kind of attempts, the danger from the trial is to be weighed againſt that from the diſeaſe: if this outweighs, it is not only reaſonable but merciful, "even with a kind of raſhneſs," as Celſus ſomewhere expreſſes it, "to ſnatch an oppor- "tunity of doing good *."

At leaſt there is more humanity in ſuch proceeding,

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* Cum quadam temeritate medicamenta arripere oportet.

ing, than in ſtifling a miſerable wretch between two feather-beds; which, as I have been informed, is the practice in a neighbouring country, and ſometimes in our own.

But the greateſt comfort is, that at any time before this ſcene of horror opens, ſimple immerſion without drowning will prove effectual. For though it is beſt to begin the method preſcribed, as ſoon after the accident as it can be done; yet where it has been neglected, even till a day or two before the calamity might be expected, (as was judged from the beginning anxiety and oppreſſion of the ſpirits), the ſucceſs has been the ſame.

Before I quit this ſubject, I muſt take notice, (as I have hinted from Van Helmont), that this action of cold water upon the body, by preſſure and conſtriction, makes it of ſingular ſervice in the cure not only of acute, but alſo of chronical deliria. Dr Willis * relates a very remarkable ſtory of a luſty young woman, who, having been raving mad ſeven or eight days, was by his order carried abroad at midnight, and thrown naked into a river, where ſhe ſwam about without help for more than a quarter of an hour; and taken out was put to bed, fell into a ſleep and large ſweats, and recovered without the help of any other remedy.

But there is no need of inſtances of this kind. Our phyſicians, who are moſt converſant in the cure of theſe maladies, find by daily experience, that this practice has a very conſiderable ſhare not only in re-

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* De anima brutorum, part. patholog. cap. x. de delirio & phrenitide.

covering their patients, but alſo in preventing a relapſe into the ſame miſery.

I am therefore ſorry to read in the Philoſophical Tranſactions *, a remark of a learned gentleman, who, upon my recommending cold bathing, propoſes rather the uſe of the hot bath: becauſe "a cold bath," he ſays, "ſhuts the pores, as a warm one opens "them." Surely he ſhould have known, that the ſhutting of the pores by a ſhort cold immerſion, is naturally followed by a glowing warmth, which relaxes and opens them; and by this means promotes perſpiration, without the diſtenſion of the veſſels by an inflammatory heat. I am afraid no bathing, whether hot or cold, would clear a head poſſeſſed with ſuch immechanical notions.

To ſay no more, whoever has rightly conſidered the Bellinian theory of melancholy and maniacal diſtempers †, will eaſily ſee the reaſon of the ſurpriſing effects of this ſafe and eaſy application, in diſpelling the greateſt calamity to which mankind is liable.

As to all other ways of curing the hydrophobia, I own I have not been ſo happy as to find any ſucceſs from the many I have tried. Bathing, at this time, is ineffectual. I have taken away large quantities of blood; have given opiates every three or four hours; tried volatile ſalts, aſa fœtida, the rad. valerian. ſylv. with other antiepileptics, in large doſes; as alſo the famous Indian remedy, muſk and cinnabar; laid on bliſtering plaſters; cooled with nitre and emulſions of barley-water, &c. All has been in vain, becauſe too late. And what is ſtill more diſcouraging is, that though ſometimes I have conquered the terrible

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* N° 443. † Vid. Bellin. de morbis capitis.

ſymptom, and brought the patient to drink freely; yet he has died in twenty-four hours with a fever and convulſions: a plain proof of what we have ſaid of the manner in which this poiſon operates.

However, nothing is to be omitted to the laſt, be the proſpect never ſo bad; becauſe that may ſucceed in one patient, which has not in a hundred. I have by me a letter from the learned Dr Boerhaave, in which, with his uſual exactneſs and judgment, he relates two caſes of the hydrophobia. In the firſt, according to the method mentioned in the hiſtory of the royal academy at Paris *, he ordered buckets of cold water to be poured, for a conſiderable time, upon the patient's head; and a clyſter, of warm water, oxymel ſimplex, and ſea-ſalt, to be injected every four hours. By theſe means he was brought to drink freely of ſmall beer, and a decoction of marſh-mallow leaves, elder flowers, and tamarinds: but, notwithſtanding theſe hopes, he died convulſed, yet calm and in his ſenſes, in a few hours.

The other caſe had a more happy event: for though the dread of liquids was attended with foaming, roaring, and the moſt miſchievous rage; yet by large doſes of nitre, (to which laudanum and diacodium were ſometimes added); by cooling the head continually with vinegar and roſe-water; bathing the feet for one hour, every night and morning, in warm water and vinegar, with ſalt; keeping the body open by tamarinds, ſyrup of violets, and frequent clyſters of water and nitre; and laſtly, eating almoſt conſtantly lemons with a little ſugar; the poor wretch was moſt perfectly recovered.

* Ann. 1699. pag. 49.

But I muſt here obſerve, that the uſe of all theſe things was entered upon four days before the dread of water began ; by which means the violence of the diſeaſe was, without doubt, very much abated : and I have great reaſon to believe, from what I have experienced, (as I have already ſaid), that the method I have recommended, would at that time even have prevented the calamity.

To conclude, if any relief could be expected in this deſperate ſtate, I think it would be from large bleeding, even ad animi deliquium, before the fibres of the membranes and veſſels have loſt their natural force by convulſions ; nitrous medicines ; and plentiful diluting with cooling ſubacid liquors. But after all, it will generally happen, that (as the Greeks ſaid upon deplorable caſes) " death will be the ph[illegible]ſician that cures *,"

E S S A Y IV.

OF POISONOUS MINERALS AND PLANTS.

THough there be a great variety of internal poiſons, as well mineral as vegetable, yet they all manifeſtly agree in their primary effects and manner of operation ; which (as is explained in the introduction) are ſomewhat analogous to the miſchief from venomous bites or ſtings : the main difference lying in this, that in the one wounds are made outwardly, in the other inwardly, that is, in the ſtomach and

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* Ἰατρὸς ἰᾶται θάνατος.

bowels; but in both caſes, the animal œconomy ſuffers in much the ſame way.

"Poiſonous medicines," ſays Dioſcorides, "are "many; but the alterations made by them in the body common, and but few *."

Of all this kind, thoſe of a mineral nature are the moſt violent and deadly, the greater gravity and ſolidity of their parts giving to theſe a force and action ſurpaſſing the miſchief of vegetable juices. And therefore, whereas noxious plants vary their effects in different creatures, ſo as to prove harmleſs, nay perhaps beneficial and nutritive to ſome, as we have before obſerved †; the ſtrength of the ſtomach in theſe animals being ſufficient to conquer and divide ſuch corroſive ſubſtances, and their blood perhaps requiring to be recruited by ſuch warm and active particles; a mineral malignity is not, at leaſt ſo far as we know, conquerable by any, but becomes univerſally hurtful and deſtructive.

We ſhall here give the firſt place to mercury ſublimate.

This is nothing but a mixture of quickſilver with common ſalt. For, though it is always prepared with nitre and vitriol added to the ſalt, in different ways, the beſt of which is that deſcribed by Tachenius ‡; yet neither of theſe enter into the compoſition, ſerving only to facilitate the work, (which they do by uniting with the alcaline parts of the ſalt, and thus freeing its acid from them); as abundantly appears

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* Ποικίλα μὲν γὰρ τὰ δηλητήρια φάρμακα, κοιναὶ δὲ καὶ οὐ πολλαὶ αἱ ἐξ αὐτῶν γινόμεναι διαθέσεις. Alexiph. p. 399.

† See the introduction.

‡ Hippocrates chymic. cap. 24.

from this experiment, that mercury ſublimed with the ſame proportion of nitre and vitriol, without ſalt, neither receives any increaſe of its weight, nor acquires any malignant quality.

The effects of this poiſon, when taken, are violent griping pains, with a diſtenſion of the belly; vomiting of a ſlimy, frothy matter, ſometimes mixed with blood, and ſtools of the ſame; an intolerable heat and thirſt, with cold ſweats, tremblings, convulſions, &c. as will appear from the following hiſtory *.

To a large dog was given a drachm of mercury ſublimate, mixed with a little bread. Within a quarter of an hour he fell into terrible vomitings, caſting up frequently a viſcid, frothy mucus, every time more and more bloody, and purged the ſame downward: till tired and ſpent with this hard ſervice, he lay down quietly as it were to ſleep, but died the next morning.

The abdomen being opened, a great quantity of extravaſated blood was found between the liver and ſtomach, and between the duplicature of the omentum about the ſtomach; the guts as well as the ſtomach were diſtended, and full of a frothy bloody mucus: on the outſide they were of a livid colour, within all over red, and inflamed down to the very rectum. The fibrous coat of the ſtomach being taken off, between that and the nervous one, grumous blood was found in ſeveral places: the like was diſcovered here and there in the inteſtines between the ſame coats.

The ſame ſymptoms with theſe, and manifeſt ſigns of a burning corroſion followed with ulcers in the

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* Wepſer de cicut. aquatic. pag. 300.

bowels, Baccius * obſerved in a young man poiſoned by ſublimate, mixed with his meat.

What we are here chiefly to examine is, how from ingredients ſingly innocent and harmleſs, ſo miſchievous a compound can reſult: for as the caſe is very plain with reſpect to ſalt, ſo is it likewiſe now notorious enough, that quickſilver itſelf, which the ancients, Dioſcorides, Galen, Pliny, &c. have unjuſtly ranked among poiſons, is in many diſeaſes, inwardly taken, of very ſafe and beneficial uſe; and that not only when diſguiſed with ſulphur, ſugar, &c. but crude, without any correction, or vainly pretended mortification.

This the Arabian phyſicians firſt gave the hint of: Avicen † having obſerved, that "they who drink "it in a large quantity, receive no hurt; its weight "making a free paſſage through the body." This was encouragement enough for the practice of giving whole pounds of it in the iliac paſſion; which is oftentimes done with good ſucceſs, without any frightful ſymptom accompanying the advantage received from its ponderoſity.

Afterwards it plainly appeared, that this mineral, either applied outwardly, or taken inwardly, though not in ſo great a doſe as could immediately force its way through the inteſtines, even when it was lodged for ſome time in this or that part, was not at all hurtful by any corroſive or malignant quality.

I remember, that I once found ſome quantity of it in the perinæum of a ſubject taken from the gallows

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* De venen. pag. 21.

† Can. Medic. l. iv. fen. 6. Argentum vivum plurimum qui bibunt, non læduntur eo: egreditur enim cum diſpoſitione ſua per inferiorem regionem.

for a diſſection, (whoſe rotten bones diſcovered what diſeaſe had required the uſe of it, and that, I ſuppoſe, by unction), without any marks of corroſion of the part where it was collected.

And Fallopius *, Braſavolus †, with others of great note, confirmed its harmleſs efficacy in the cure of the worms, not only in adult perſons, but even in the more tender conſtitutions of children.

Nor are theſe the only caſes in which good ſervice may be had from this weighty fluid. He that rightly conſiders the ſtate of the animal œconomy, the various alterations it ſuffers from the ſtagnation of its more viſcid juices in the ſmalleſt canals, and how much the impulſe and force of the circulating blood, by which obſtructions are to be removed, muſt be increaſed by its carrying along with it ſuch particles as the mercurial globuli ; will perhaps ſee good reaſon to allow, that the prudent management of quickſilver may do that in ſome obſtinate and dangerous diſeaſes, which we cannot promiſe ourſelves from any other of our known medicines whatſoever.

But I ſhall not enlarge upon this head. The learned Dr Cheyne has thoroughly explained the mechaniſm by which ſuch effects as theſe are produced ‡. However, as all great medicines are to be looked upon as edge-tools, ſo this, as much as any, requires caution ; and indeed more than is commonly obſerved by thoſe who are moſt bold in the uſe of it.

For it cannot be denied, that the exceſſive gravity alone of this mineral, however ſerviceable in other re-

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* De morb. Gallic. cap. lxxvi.

† De morb. Gall. inter autores de morb. Gall. p. 599.

‡ New theory of continual fevers.

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‡ New theory of continual fevers.

ſpects, may, if it happens to lie in any quantity in the interſtices of the nervous filaments, induce ſymptoms of dangerous conſequence, as ſpaſms, contractions, palſies, &c. which we find they commonly ſuffer, who have either been for a long time employed in rubbing quickſilver upon looking-glaſſes, or in any work by which they are obliged to draw in mercurial fumes with their breath, or who have been too much daubed with mercurial ointments; as ſhall be obſerved anon.

Neither is this all. Experience has convinced us, that repeated doſes of crude mercury have in ſome caſes, even a conſiderable time after they have been taken, exerted their force, and thrown the body into unexpected diſorders.

I remember two accidents of this kind, (and one of them proved fatal), in which when ſmall quantities had been given for many days together, a violent ſalivation enſued more than two months after the uſe of it had been left off.

And not long ſince, I ſaw a young lady, who having ſwallowed about ſix drachms every morning, three ſucceſſive days, was ſalivated three weeks. The flux then ceaſed, but returned after ſix months, and held a month; and once more came on, in the ſame manner, two months after. The breath was each time ſtrongly affected, as is uſual in mercurial ſpittings. So ſurpriſingly active is this mineral, even ſimple and uncompounded.

We may learn from hence, that it will be always right, in dealing with this ſlippery remedy, to take care that it has a free paſſage through the body; which muſt be done either by purging, or by combining

ning it with ſubſtances, which will carry it off either by perſpiration or urine : for what is called alcaliſing it, does not deſerve the name of a preparation.

Now as to ſublimate, moſt certain it is, that the ſaline particles impart to the mercury this noxious quality ; or, to ſpeak more properly, that the ſalt receives from the mercurial corpuſcles ſuch an increaſe of its gravity and momentum, as renders its cutting corroſion more effectual and penetrating : for the manner after which this matter is done, is probably this.

The compounding parts of the mercury, though ſo minutely divided by the action of the fire, as to riſe in the form of a fume, yet are ſtill ſolid and ponderous bodies : and by reaſon of their extreme parvity, being perhaps ſimple and elementary corpuſcles, they will eaſily be lodged in the pores and interſtices of the ſaline cryſtals ; which being compoſed of the atoms of ſalt, variouſly by ſublimation combined and united, are a kind of cutting lamellæ or blades ; the force of which could never have been very penetrating, upon the account of their lightneſs and eaſy diſſolution, if the mercury, without blunting their edge, or breaking their figure, did not lend them an additional weight, and thus at the ſame time ſtrengthen their action, and prevent their quick ſolution by the juices of the ſtomach : which cannot now disjoin their compounding parts, becauſe the vacuities, into which they ſhould, in order to do this, inſinuate themſelves, are already poſſeſſed, and taken up by the mercurial globules.

In ſhort, theſe cryſtals, which are to be conſidered as ſo many ſharp knives or daggers, wounding and ſtabbing the tender coats of the ſtomach, and abrading their natural mucus, will irritate the nervous liquor: upon which convulſions and vomitings, with exceſſive pains, muſt follow. And the blood-veſſels being at the ſame time pricked, all the adjacent parts will be inflamed, the blood will ſtagnate: then come on ulcers, which, though ſingly ſmall, yet being many in number, do all together make up large gangrenes.

This being the nature of ſublimed mercury, it may not be amiſs to inquire, how it comes to paſs, that this ſame compound reſublimed with live mercury in the proportion of four parts to three, (for the ſublimate will not take up an equal quantity), eſpecially if the work be repeated three or four times, loſes its corroſiveneſs to that degree as to become not only a ſafe, but, in many caſes, a noble medicine. For I do not ſee, that any of the chemical writers have hit upon the true ſolution of this phænomenon.

Here then it is to be conſidered, that the action of the ſaline cryſtals depending upon their ſolidity and largeneſs, theſe muſt neceſſarily, by every ſubſequent ſublimation, be broken into ſmaller and ſmaller parts. The mercurial globules, (for the reaſons given by the author of the forementioned theory of fevers), ariſing more quickly and eaſily than the ſalts, quit the interſtices in which they were lodged, and the cryſtalline blades are divided every time more and more by the force of the fire: whereupon a new combination of parts ſucceeds. And although there be a greater proportion of the mineral to the ſalts than before, which makes dulcified mercury ſpecifically heavier than the corroſive; (for this contains two parts of ſalt, and one of mercury ; whereas the dulcified, well prepared, has equal parts); yet the broken pieces of the cryſtals uniting into little maſſes of differing figures from their former make, thoſe cutting points are now ſo much ſmaller, that they cannot make wounds deep enough to be equally miſchievous and deadly ; and therefore do only vellicate and twitch the ſenſible membranes of the ſtomach to that degree, as excites them to an excretion of their contents and glandular juices, upward or downward, according as the force of irritation is greater or leſs.

Thus a violent poiſon is mitigated into a vomit or purge : nay, it may eaſily happen, (eſpecially in robuſt conſtitutions, and if the bowels be at the ſame time by any means defended againſt the ſtimulating power of the medicine), that this twitching may be ſo ſlight, as to be almoſt inſenſible, and hardly troubleſome. And then the mercurial globules, being freed indeed from moſt of the ſaline parts in their paſſage through the primæ viæ, but ſtill having a mixture of ſome few of them, are quickly conveyed into the blood ; where, by their motion and weight, they muſt neceſſarily diſſolve the preternatural coheſions of all the liquors, particularly of thoſe which circulate in the ſmalleſt canals, and are moſt viſcid and tenacious, making them more fluxil and thin, or of more eaſy ſecretion. Whereupon all the glands of the body are, as it were, ſet to work, and ſcoured of their contents : but the ſalival ones eſpecially, being many in number, very large and wide, and the juice they ſeparate of a tough and ropy ſubſtance, ſo that a conſiderable quantity of it is accumulated, before it is forced out at the orifices of the ducts ; theſe effects will be moſt remarkable in them, and a ſalivation or ſpitting muſt continue ſo long, till the active mineral particles are, through theſe and the other paſſages, diſcharged out of the body.

As the difference between mercury corroſive and dulcified lies in a greater and leſſer degree of operation and force, ſo this ſame conſideration diſtinguiſhes the ſeveral preparations of this mineral from each other; which though very many, yet do all vary their effects in the body, only according as the mercurial globules are differently combined with ſalts, and the points of theſe more or leſs broken by the action of the fire, in the burning of ſpirits upon them, and ſuch like managements: and therefore, however dignified with the great names of arcana, panaceæ, prince's powders, &c. they do not afford us any thing ſingular and extraordinary, beyond what we may with equal advantage promiſe ourſelves from ſome or other of the moſt common and uſual proceſſes.

We may alſo fairly conclude from this reaſoning, that the ſafeſt way of raiſing a ſalivation is by internal medicines; ſince whatever miſchiefs can be apprehended from theſe, may in a greater degree follow from the external uſe of mercury: not only becauſe, as we have already hinted, the mineral globules, being intimately combined with ſalts in the ſeveral preparations given inwardly, will, by the irritation of theſe, be eaſily and fully thrown out at the organs of ſecretions, till the blood is quite diſcharged of its load; whereas in all the daubings with mercurial ointments, we can never be certain, that none of the heavy particles are left lodged in the interſtices of the fibres, or cells of the bones; but alſo in as much as, by computing the portion of mercury in all the doſes neceſſary to promote a ſpitting, and the weight of the ſame mineral uſually applied when this is done by unction, it will appear that the quantity in the latter caſe vaſtly exceeds that in the former, and conſequently that the inconveniencies to be feared will be in the ſame proportion.

Therefore this external management of quickſilver is chiefly to be recommended where the conſtitution is not broken, or ulcers and tumours require a particular cure, by liniments, &c. and a more thorough cleanſing of the body. And even in ſuch caſes, it will certainly be beſt to anoint daily with ſmall quantities, and not to raiſe a high ſpitting ; but promote the other ſecretions, particularly ſweating and urine, by plentiful drinking of thin liquors ; and alſo, if there be occaſion, by laxative medicines : for it is well known, that cures are often wrought by theſe means, although the mouth has never been ulcerated by the mercury. At leaſt this method will be a remedy for a time ; and enable the patient to recover ſtrength ; ſo that he may afterward, if it be neceſſary, undergo a more ſevere treatment.

It may be obſerved, that as the earlieſt uſe of mercury was in unguents and emplaſters, ſo moſt of the prejudices and outcries againſt it are owing to effects produced this way. For the firſt attempts of the cure of venereal maladies by this remedy were learned from the Arabians *, who, having recommended mercurial ointments in the lepra or ſcabies, gave a handle to the

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* Vid. Joan. Baptiſt. Montan. tract. de morb. Gallic. inter autor. de morb. Gall. p. 482. & Fallop. de morb. Gall. cap. lxxvi.

the Italian phyſicians to try their efficacy in removing the foulneſs of the ſkin from a new and terrible contagion: neither were they ſparing of their liniments, which they continued to rub in for twelve, fifteen, nay ſometimes for above thirty days together *. So that it is no wonder, if they often met with very untoward ſymptoms from ſo ſevere a treatment; and if (as ſome of them † affirm) they now and then found mercury in the rotten bones of their patients, who had, it may be, ſuffered too much both from their diſeaſe and their phyſician.

There are many hiſtories of this kind; neither are inſtances wanting in living perſons of mercury running out of the body, from a tumour, either ſuppurated, or opened by a cauſtic: nay, there is a caſe upon record, in which, upon opening a vein, ſome drachms of it flowed out with the blood ‡.

To this examination of the properties and effects of mercury, I ſhall add an inquiry into the nature of another mineral poiſon, not very unlike it, either in its make or action; this is arſenic.

There is ſome confuſion in the accounts which authors give of this mineral. This ariſes from their not diſtinguiſhing the arſenic of the ancients from what is now ſo called. I ſhall therefore exactly de-

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* Nicol. Maſſa de morb. Gall. tract. iv. cap. 2.

† Argentum vivum accepi ex oſſe cujuſdam corrupto, quem perunctum ab empyricis plus decies ferebant, non ſemel emanaviſſe. Anton. Gall. in lib. de ligno ſancto non permiſcendo.

Non ſemel in ſepulchris argentum vivum in mortuorum capitibus reperi. Anton. Muſa Braſavolus in tract. de morb. Gall.

‡ Vid. Ephemerid. Germanic. dec. 3. ann. 5. obſerv. 172.

ſcribe both the one and the other, not only from the lateſt writers of natural hiſtory, (for what Agricola, Matthiolus, Schroder, and even Wepfer, the beſt authors extant when this book was firſt publiſhed, have delivered to us on this ſubject, is all wrong), but more particularly from ſome experiments communicated to me by the learned Dr Hampe, a moſt excellent chemiſt, phyſician to her Royal Highneſs the Princeſs of Wales.

The arſenic of the Greeks, Ἀρσενικὸν or Ἀῤῥενικὸν, was what the Latins named *Auripigmentum*, we *Orpiment*.

This is found in Greece and Hungary, in particular mines and veins, and is never mixed with any other mineral. It is of a foliaceous or laminated texture, and contains a great deal of ſulphur; as appears by its inflammability, and by its giving, when mixed with mercury ſublimate, a true cinnabar. By ſimple fuſion it runs into a maſs of a cinnabarine colour, called *ſandaracha*. Though it yields a regulus, in every reſpect like to the regulus of true arſenic, yet it does not act as a ſtrong poiſon. Hoffman * gave a good quantity of it to a dog, without any harm. The reaſon of this is, becauſe its metallic particles are combined with ſulphur, and not with ſalt, at leaſt in any conſiderable degree.

Such a compoſition makes this ſubſtance more uſeful in painting than in phyſic; and, together with its colour, has induced thoſe chemiſts who have fancied that metals may be tranſmuted, to take it for the ſubject-matter of their great work: for ſo they call the making of gold. They have very fondly grounded their hopes upon ſome odd ænigmatical verſes in the Sibylline oracles *. But though ſome learned men have attempted to explain this riddle, as deſcriptive of the Greek name Ἀρσενικὸν; yet none have ſo far ſucceeded, as fully to reconcile the numbers therein expreſſed at length, with thoſe contained in the letters of which that word conſiſts †. However, be that as it will, true it is, that this great expectation from this mineral is as old at leaſt as the time of Caligula, that is, of a more ancient date conſiderably, than the far greateſt part of theſe ſuppoſititious and ill-contrived compoſitions, which bear the ſacred name of *oracles*: for that covetous emperor, as Pliny relates ‡, ordered a great quantity of orpiment to be melted and managed, that he might extract gold out of it; and made ſome, but (as it uſually happens in ſuch experiments) the profit did not anſwer the expenſe.

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* Obſerv. phyſico-chym. lib. iii. obſ. 1.

What we now call *arſenic* is of three ſorts, white, yellow, and red. All theſe are factitious, and very probably not known to the ancients. They are made in this manner.

At Schneebergh in Miſnia there is found, in great quantities, a particular kind of mineral called *cobalt*, of a greyiſh colour, and ponderous. This roaſted and calcined, in a furnace made for that purpoſe, yields a white ſmoke, which gathers, at the end of a very long funnel, into an aſh-coloured powder, as fine as flour. This, with the addition of a true proportion of potaſh, is ſublimed, and gives the white cryſtalline arſenic *.

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* Ἐννέα γράμματ' ἔχω, τετρασύλλαβός εἰμι, νόει με.
Αἱ τρεῖς αἱ πρῶται δύο γράμματ' ἔχουσιν ἑκάστη,
Ἡ λοιπὴ δὲ τὰ λοιπά, ϗ εἰσὶν ἄφωνα τὰ πέντε.
Τοῦ παντὸς δ' ἀριθμοῦ ἑκατοντάδες εἰσὶ δὶς ὀκτὼ,
Καὶ τρεῖς τρὶς δεκάδες, ϗ δὶς τρία. Lib. i.

† Vid. Fabric. bibl. Græc. v. xii. p. 696.

‡ Nat. hiſt. lib. xxxiii. c. 4.

The metallic earth, of a vitreous nature, which remains after this operation, melted with a due proportion of calcined flints and potaſh, makes what is called *ſmalt*. The cobalt contains about three parts of arſenic, and one of this earth.

When newly ſublimed and perfectly pure, it is a ſhining white tranſparent body, not unlike to a metallic glaſs: in the air it changes its bright whiteneſs to a milky colour, and becomes entirely opake. It is not inflammable; but evaporates in the fire, without leaving any earth behind, in a white ſmoke, ſmelling like garlick. It affords a ſemimetallic regulus, both by ſublimation and precipitation. The firſt is foliaceous, light, and ſpongy; the other ponderous, though alſo of a foliaceous texture, and reſembles biſmuth. This laſt regulus may be made without iron, with the black flux only; or with nitre and tartar, in the ſame manner as is the regulus of antimony; but it requires a nice operator.

White arſenic is entirely ſoluble in water. If one part of it be ſufficiently boiled in fifteen parts of diſtilled or rain water, it gives by evaporation ſalts of triangular planes, which unite into octoedral cryſtals: and in theſe, either beat to powder, or diſſolved by boiling, metallic globules, reſembling thoſe of quickſilver, are plainly diſcovered by the microſcope. Which confirms what Kunckel ſays, that a great part of arſenic is mercury [*]: ſo that arſenic may be defined to be a volatile metallic ſalt.

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* See Kunckel's annotations upon Neri's art of glaſs, in German; and Philoſophical Tranſact. N° 293.

Yellow arſenic is prepared by ſubliming white arſenic with the addition of a tenth part of ſulphur. This is not ſo tranſparent as the white, but ſplendid, and very like to a metallic yellow glaſs.

The red differs from the yellow only in this, that a greater quantity of ſulphur is added, together with a particular kind of a red cobalt called *kupfer nickel*.

This being the compoſition of this mineral, we may readily underſtand the manner of its deadly operation. The caſe is plainly the ſame with that of ſublimate corroſive; and as there the ſalts combined with the mercurial globules form cutting cryſtals; ſo here the metallic particles, which make the regulus, give a force and ſolidity to the ſaline bodies, which wound the ſtomach and guts, as the others do, even to ſuch a degree as to cauſe mortifications.

The ſeveral hiſtories related by Wepfer [†] put this out of queſtion: it is ſufficient to our purpoſe to mention one.

A dog having eat ſome fat mixed with white arſenic, died the next day. The upper part of the ſtomach, when opened, was red and inflamed; the coats thinner than ordinary; the bottom of it was covered with a fetid ſlime, and ſome pieces of fat: the thin guts were ſo corroded, as to be pervious in three places, two of the ulcers ſo large that they would eaſily admit a bean: the cavity of the abdomen contained a yellowiſh ichor tinged with blood.

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[*] Chemical philoſophy confirmed by experiments, chap. xi. in Pyrotechnical diſcourſes. Lond. 1705. 8vo.

[†] Cicut. aquat. hiſt. p. 274. & ſeq.

The caſe being thus, one would wonder, what ſhould induce authors to preſcribe ſo corroſive a mineral to be worn upon the pit of the ſtomach, as an amulet againſt the plague. This trick we may well believe to be dangerous, when Lionardo di Capoa [*] tells us of a child killed by the violent vomiting and purging, occaſioned from a ſlight wound made in the head by a comb wet with oil, in which arſenic had been infuſed: for the pores of the body being opened by heat and exerciſe, ſome of the noxious effluvia might eaſily inſinuate themſelves into the part. Accordingly Crato [†] obſerved an ulcer of the breaſt cauſed by this application; Verzaſcha [‡] violent pains, and fainting fits; Diemerbroeck [||], and Dr Hodges [⸸], death itſelf.

The truth of the matter is, this practice ſeems to owe its origin to a miſtake. Perhaps ſome of the Arabian phyſicians had commended darſini worn in a bag for a preſervative in plague-time. This in their language ſignifies cinnamon: but the Latin interpreters retaining the ſame word in their tranſlations, (as was frequently done), one or other afterward not underſtanding its meaning, and deceived by the likeneſs of the ſound, ſubſtituted in its place *de arſenico*, as if darſini were all one with zarnich. The authority of the firſt author ſerved to propagate the error: nor were thoſe wanting, who reaſoned upon the matter, and found it agreeable to their philoſophy, that this mineral ſhould draw to itſelf and concenter the arſenical effluvia out of the air, and thus ſecure the body from their infection; theſe being, as they imagined, the common cauſe of peſtilential diſeaſes.

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[*] Incertezza de' medicamenti, pag. 82.

[†] Epiſtol. 168.

[‡] Obſerv. 66.

[||] De peſte, hiſtor. 99. annotat.

[⸸] De peſte Lond. pag. 239.

Having thus particularly diſcourſed of the nature of theſe two poiſons, I ſhall not need to inſiſt upon any more out of the mineral kingdom.

All of them bear ſome analogy to the former, and are more or leſs dangerous, according as their ſalts receive a differing force from the metallic particles. For this reaſon, as we have obſerved, that the moſt virulent may be mitigated by breaking the points of the ſaline cryſtals; ſo on the other hand, the moſt innocent minerals may become corroſive, by combining them with ſalts; as we ſee in the ſeveral preparations of ſilver, antimony, iron, &c.

This puts me in mind of making a remark, which I think both curious and uſeful. It is obſerved, that the fumes of lead are very noxious to thoſe who are conſtantly employed in melting it, as plumbers, caſters of ſhot, &c. A learned phyſician, of my acquaintance, lately told me, that a great artiſt in this way had aſſured him, he had found by experience, that this inconvenience did not attend the melting new lead, in any degree ſo much as it did the melting it when it was old: that he had workmen, who had for many years laboured under him, in caſting new metal, and had never ſuffered in their health by it. This difference he rightly aſcribed to the corroſive quality which lead acquires from the ſalts in the air, by lying long expoſed to it.

For the fumes of minerals are only parts of the reſpective ſubſtances minutely divided; and therefore will not only produce ſuitable effects, but alſo in a more dangerous way; being not ſo much guarded againſt,

gainſt, and yet admitted farther into the body, that is, into the lungs, in reſpiration, as well as into the ſtomach, by means of the ſaliva: not to mention the impreſſion upon the ſpirits in the noſtrils, which muſt certainly be very conſiderable.

I had once in my poſſeſſion, given me by an ingenious chemiſt, a clear liquor, which though ponderous, was ſo volatile, that it would all fly away in the open air, without being heated; and ſo corroſive, that a glaſs ſtopple of the bottle which contained it, was in a ſhort time ſo eroded, that it could never be taken out. The fume from it was ſo thin, that if a candle was ſet at ſome diſtance from the bottle, upon a table, the heat would direct its courſe that way; ſo that it might be poiſonous to any one that ſat near to the light, and to no body beſides. I know the compoſition of this ſtygian ſpirit; but it is better, that the world ſhould not be inſtructed in ſuch arts of death. It is ſufficient to our purpoſe to obſerve, that it was ſalts combined with metallic bodies.

OF POISONOUS PLANTS.

FRom minerals we come to poiſonous plants. The moſt noted of theſe are the cicuta and aconitum. The former is of two ſorts, our common hemlock; and the aquatica, which Mr Ray calls *cicutaria paluſtris tenuifolia*.

What the cicuta, ſo much in uſe of old for killing, eſpecially at Athens, was, we don't know: it is moſt probable, that it was not a ſimple, but compounded thing. The hiſtory of the noble death of Socrates, related by his diſciple Plato *, (if this is not wrought up with more of ornament than truth), ſeems to evince it to have been a mixture of ſome anodyne juices with others of a corroſive nature. Theophraſtus † ſays, that Thraſyas, a great phyſician, had invented a compoſition, which would cauſe death without any pain; and that this was prepared with the juice of hemlock and poppy together, and did the buſineſs in a ſmall doſe.

An extract of this kind might perhaps take away life with ſuch ſymptoms as this great philoſopher went off with, viz. eyes fixed, heavineſs and inſenſibility in the legs, then great coldneſs in them, which by degrees ſeized the vital parts.

I am the more inclined to believe this, from what is recorded anciently of the people of Marſeilles, that they had a poiſon kept by the public, in which cicuta was only an ingredient; a doſe of which was allowed by the magiſtrates to any one who could ſhew a reaſon why he ſhould deſire death. For this cuſtom, as Valerius Maximus obſerves ‡, came from Greece, particularly from the iſland Ceos, where he ſaw an example of it in a woman of great quality, who, having lived very happy ninety years, obtained leave to die this way, leſt by living longer ſhe ſhould happen to ſee a change of her good fortune.

But the cicuta aquatica, at leaſt in our colder countries, is much more violent than the other. Wepfer has, in a very learned treatiſe, deſcribed its deadly effects in ſome children, who by miſtake had eat of the roots of it. Theſe were exceſſive pain and

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* Phædon. ſub finem. † Hiſt. plant. lib. ix. c. 17.

‡ Lib. ii. c. 6. § 8. Vid. Ælian. var. hiſt. lib. iii. c. 37.

heat in the ſtomach; terrible convulſions, with the loſs of the ſenſes; diſtortion of the eyes; flowing of blood out at the ears; the jaws ſo hard ſhut that no force could open them; efforts to vomit, but nothing thrown up; frequent hickups; with a great diſtenſion and ſwelling, eſpecially at the pit of the ſtomach; and when death had concluded the tragedy, a continued running of green froth at the mouth.

Stalpart Vander Wiel gives the like account of two perſons killed at the Hague by the ſame roots *.

In a dog, that, for experiment's ſake, died by this poiſon, the ſtomach when opened was found quite conſtringed, and ſhut up at both orifices; its inward ſurface red, with livid ſpots here and there.

Thus it appears, that this plant conſiſts of hot, acrid, and corroſive parts; which by rarefying the natural juices of the ſtomach, and hurting its nerves, are the cauſe of thoſe terrible diſorders which have been deſcribed.

For, upon the ſenſe of a violent irritation and pain, the nervous fluid is by the mind, in a kind of ſurpriſe and hurry, determined in great quantities to the affected part; in order to throw off the cauſe of the diſagreeable ſenſation: which, if the ſtimulus be not over great, is done by the contraction of the fibres of the ſtomach, and muſcles of the abdomen, cauſing vomiting. But when the painful twitching is quite intolerable, the buſineſs is over-done; and the fibres are drawn into ſpaſms, which contract the mouth of the ſtomach, ſo that the noxious matter cannot be diſcharged, but is kept there in continued force and action. And by the communication of the

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* Obſervat. cent. 1. obſ. 43.

infection through the nervous ſyſtem, the whole body quickly ſuffers; the blood-veſſels are torn and broken by the violence of the convulſions, and blood guſhes out from the ears, noſtrils, &c.

This univerſal muſcular contraction was the reaſon, that one of the children attended by Wepfer, made urine in the midſt of the agony, to the height of five or ſix feet, with a ſtrength and violence ſurpriſing to the ſpectators.

The caſe of the aconitum is much the ſame. This is our napellus or monks-hood; and its effects do ſo nearly agree with thoſe now related of the cicuta, that I ſhall not need to recite them: the experiments of Wepfer * are full and convincing. And indeed, as all the hiſtories which this ſame author has ſo carefully given us, of trials made with ſeveral vegetable poiſons, as the ſolanum, nux vomica, cocculus Indicus, &c. on different creatures, put it out of all doubt, that the common miſchief of theſe is a twitching and ſlight inflammation of the ſtomach, with an affection of the nervous fluid; ſo it appears from hence, that virulent plants, although they may be diſtinguiſhed even from one another by particular virtues, do however kill by a like operation and force, which differs chiefly in degree from that of noxious minerals.

Nor is it at all ſtrange, that the ſymptoms from a vegetable, and from a mineral virulency, ſhould be ſo different, although of the ſame kind, and only of unequal force: for the more ſolid parts of minerals, eroding the coats of the ſtomach, induce a perfect mortification and gangrene, and thus do their work

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* Pag. 176 ſeq.

at once; whereas the weaker ſalts of plants can make only pungent irritations, upon the painful ſenſe of which the animal is thrown into convulſions, and dies by theſe prevailing in all parts of the body.

Upon this ſcore, though mineral poiſons do not commonly paſs the primæ viæ, vegetable ones in ſome caſes may: juſt as we find that thoſe medicines which have a great degree of irritation, preſently induce a vomiting; whereas the ſame twitching a little weakened ſuffers them to paſs into the inteſtines, and work downward by ſtools.

By this we may perhaps give ſome gueſs at the nature of thoſe poiſons with which they tell us the natives in ſomc parts of Africa and India are ſo expert at killing, that they can do it in a longer or ſhorter time. Theſe are moſt probably either the fruits, or the inſpiſſated juices of corroſive plants, which inflaming the bowels, may cauſe little ulcers there, whoſe fatal conſequences, we know, may very well be ſlow and lingering.

This I am the rather induced to believe, becauſe an ingenious ſurgeon, who lived in Guinea, told me, that the antidote by which the negroes would ſometimes cure thoſe who were poiſoned, was the leaf of an herb, which purged both upward and downward. For by this means the ſtomach might be cleared from the adhering corroſive parts of the venom. Yet I can hardly think it poſſible at the ſame time, that they ſhould be able, by varying the compoſition or quantity of the doſe, to aſcertain the time in which it ſhall kill, to a week, month, &c.; nor have I ever met with any perſon who could atteſt this to be matter of fact: though repeated trials and obſervations may help one well practiſed in ſuch tricks to give notable conjectures in this point.

The ancients indeed pretended much the ſame thing with their aconitum, of which they ſeem to have made a kind of ſecret and myſtery; as we learn from Theophraſtus *, who ſays, "the ordering of this "poiſon was different, according as it was deſigned to "kill in two, three months, or a year." But this he relates only as a common tale or opinion, and not as a ſtory to which himſelf gave any manner of credit.

It is very plain, that the common cure of all poiſons taken into the ſtomach, muſt be by throwing them up again by vomiting as ſoon as poſſible, and defending the membranes from their pungent acrimony. Drinking very large quantities of warm milk, with oil of ſweet almonds, till the vomiting ceaſes, will anſwer the firſt intention: the other, in mineral poiſons, (for the effects of the vegetable, after they have been vomited up, generally go off, by diluting plentifully with ſoft and fat liquids), requires particular care, which, I think, may be in this way. We have found the force of theſe to depend upon a combination of metallic particles with ſaline cryſtals: therefore the diſuniting of theſe muſt deſtroy their power. This (as Kunckel † has hinted) may be done, by drinking a quantity of a lixivium, made by a ſolution of ſalt of tartar in water: for this ſalt, uniting with the corroſive cryſtalline ſalt, will (after ſome degree of efferveſcence) kill it, as the chymiſts ſpeak; by

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* Hiſt. plant. lib. ix. c. 16.

† Chemical philoſophy confirmed by experiments.

by which means, being diſengaged from the mineral globules, it will be rendered of no effect.

This practice is founded upon a remarkable experiment, related by the ſame author; which is this. A child's head, for the cure of ſcabs, was daubed over with an ointment made of ung. pomat. and ſublimate corroſive: this immediately cauſed ſuch a ſwelling, with intenſe pain and inflammation, that the eyes and noſe could not be ſeen. In this extremity, when the patient was thought to be dying, a learned chymiſt, happily coming to the houſe, adviſed to foment the head all over with a ſtrong lixivium: this, in a few hours, quite removed the terrible ſymptoms.

What ſuch an application could do outwardly, it may, upon the ſame rational grounds, be preſumed it will perform likewiſe in the ſtomach, at leaſt in ſome degree; and thus become an antidote againſt the moſt violent of all known poiſons.

ESSAY V.

OF OPIUM.

THE ancients having experienced, that opium would oftentimes kill, though taken in no large quantity, ranked it with poiſons, and gave it the firſt place among thoſe which from their ſtupefying quality they called narcotic.

True indeed it is, that we do every day find this to be, in a ſmall doſe, one of the moſt noble remedies in the world. But it is not worth the while to engage in the controverſy, how far poiſons are medicinal: ſince it is notorious enough, that medicines ſometimes prove poiſonous. And take the matter as we pleaſe, it may ſerve to very good purpoſes to underſtand the manner of operation of ſo celebrated a drug, and help us in a great meaſure to aſcertain its uſe in different caſes, if we are beforehand rightly appriſed of its nature and way of acting.

In order hereunto, it is neceſſary, beſides ſome other præcognita, ſince one of the chief virtues of this medicine is hypnotic, to define diſtinctly what ſleep is, or rather, (to avoid confuſion and diſputes about words), what difference there is between an animal body, when aſleep and when awake: for I ſuppoſe the hiſtory, manner of preparing, &c. of opium, to be already known.

Firſt, then, there is no one but knows, that in ſleep there is a ceſſation from action. When waking, we walk, diſcourſe, move this or that limb, &c. but in natural and undiſturbed reſt there is nothing of all theſe: that is, whereas, being awake, we perform ſeveral motions by the voluntary contraction of our muſcles; when aſleep, thoſe muſcles only are contracted, whoſe action is in a manner involuntary, or to which the mind has always ſo conſtantly determined the ſpirits, that it does it by a habit, without the intervention of the reaſoning faculty: ſuch are thoſe of the heart and breaſt.

So that there is at this time a kind of relaxation or looſeneſs of the moving fibres of the ſeveral members; or at leaſt ſuch a quiet poſition and ſtate of them, by which all the antagoniſt muſcles are in an æquilibrium and equality of action, not overpowering one another. For this indeed ſeems to be one great deſign of ſleep, to recover to the parts overſtretched by labour their former tone and force: and therefore we naturally, when compoſing ourſelves to reſt, put our body into that poſture, which does moſt favour the particularly wearied limbs, and conduce to this end.

In the next place, it is very plain that there is in ſleep not only a reſt, and ſuſpenſion from acting, of moſt of our bodily organs, but even of our thinking faculty too; that is, (for I would prevent cavils), a ceaſing from ſuch thoughts, as when waking we are exerciſed about, which we reflect upon, and will to employ our mind with. For though dreams are thoughts, yet they are but imperfect and incoherent ones, and are indeed either ſo faint and languid repreſentations, as to be conſiſtent with our ſleep, as ſome may be; or elſe, if they be ſtrong and lively, they are, as every one knows, the interruption and diſturbance of it.

From hence it will follow, that the motion of the arterial fluid muſt be, ceteris paribus, more ſedate, even, and regular, in the time of ſleeping than waking. For, beſides the various alterations which in the latter ſtate this receives from the ſeveral paſſions of the mind, the very contractions of the muſcles themſelves in exerciſes of the body differently forward its courſe: whereas in ſleep the force of the heart and pectoral muſcles being more conſtant and uniform, gives it a more calm and equally continued impulſe.

Hence alſo it will come to paſs, that the influx of the liquor of the nerves into the organs of the body, as alſo its reflux towards the brain, is in ſleep either none, or very inconſiderable; that is, that this fluid has at this time but little or no motion. For it is muſcular action and ſenſation that require it to be thus determined this way or that, which are now hardly any. And yet, by the arrival of blood at the brain, this juice will ſtill be ſeparated there, fit to be derived into its canals or tubes : ſo that by this means there will be a kind of accumulation, or laying up in ſtore, of ſpirits for the offices and requirements of waking.

Thus we may in ſhort look upon the time of watching, as the time of wearing out, or the deſtruction of the animal fabric ; and the time of ſleep, as that in which it is repaired and recruited ; not only upon the account of what we have juſt mentioned concerning the nervous liquor, but alſo with reſpect to all the other parts, as well fluid as ſolid. For action does neceſſarily by degrees impair the ſprings and organs ; and in motion ſomething is continually abraded and ſtruck off from the diſtractile fibres, which cannot otherwiſe be reſtored than by their being at reſt from tenſion. Beſides that, ſuch a regular and ſteady courſe of the blood, as we have obſerved to be in ſleep, is by far more fit and proper for nutrition, or an appoſition of parts to the veſſels, which an uneven hurry of it is more apt to tear off and waſh away.

The caſe being thus, it is very plain, that whatſoever can induce ſuch a diſpoſition of the fluids and muſcular parts of the body, as this we have deſcribed, will ſo far cauſe ſleepineſs. And in like manner, when any thing interpoſes and hinders this compoſedneſs and tranquillity, the removing of the impediment will be the cauſing of ſleep : inaſmuch as this is only reducing the animal œconomy to its right ſtate, in which by natural order there muſt be a ſucceſſion of ſleeping and waking.

Thus it appears how neceſſarily continued exerciſes make us ſleepy, ſince theſe exhauſt the juice of the nerves; that is, both leſſen its influx into the organs of motion, and incline the mind not to determine it any longer that way, upon the account of the pain and uneaſineſs with which too violent a tenſion of the parts is always attended: which therefore we muſt needs deſire to relax, or lay to reſt.

That ſleepineſs which follows upon a fulneſs of the ſtomach after eating or drinking, is owing to a different cauſe; and does indeed ſo nearly fall in with the effects of opiate medicines, that it requires a particular conſideration.

As hunger, or the emptineſs of the ſtomach, is a painful ſenſation; ſo the ſatisfying, or removing of this, is a pleaſing or agreeable one. Now, all pain is a ſtimulus upon the part affected; and this, we all know, being attended with contractions of the pained membranes, cauſes a greater afflux than ordinary of the nervous juice that way. On the other hand, pleaſure, or a delightful ſenſation in any part, is accompanied with a ſmooth undulation, and eaſy reflux of the liquor of the nerves towards the brain. This is, as it were, the entertainment of the mind, with which being taken up, it does not determine the ſpirits to the organs of motion: that is, there is ſuch a relaxation of the muſcular fibres, and ſuch a diſpoſition of the nervous fluid, as we have obſerved to be neceſſary to ſleep.

This is the reaſon of that chillineſs in the limbs which we commonly complain of after a good feaſt.

If it ſeem ſtrange, that a pleaſure in the ſtomach ſhould ſo powerfully influence the mind; let it be

conſidered,

conſidered, on the other hand, how violent effects an uneaſy and diſagreeable ſenſe in the ſame part does produce; what a terrible agony two or three grains of crocus metallorum throws the whole fabric into; how readily the fluid of the nerves is with a more than ordinary impetus determined and commanded into the muſcles of the ſtomach and abdomen, in order to throw off the enemy, and remove the ungrateful ſenſation.

Now, the conſequences which we have aſcribed to a pleaſing ſenſe in this part, are only juſt the contrary of theſe we find the oppoſite affection of pain induces. And indeed pleaſure and pain are two great ſprings of action in the animal œconomy; the changes they make in the fabric are the cauſes of many effects which ſeem ſurpriſing, becauſe we do not regard the mechaniſm by which they are produced: but theſe muſt be more conſiderable in the ſtomach than any where elſe; this part being, for very wiſe purpoſes, of ſo acute a feeling, that ſome philoſophers have for this reaſon thought it to be the ſeat of the ſoul.

Beſides this conſideration, we muſt take notice, that the ſtomach, being diſtended with food, preſſes upon the deſcending trunk of the aorta, and thus cauſes a greater fulneſs of the veſſels in the upper parts: whereupon the brain is loaded, or the derivation of ſpirits into the nerves diminiſhed, and inactivity or drowſineſs enſues. From hence proceed thoſe fluſhings in the face, redneſs, &c. after plentiful eating or drinking, moſt viſible in thoſe whoſe veſſels are lax and weak; as in exhauſted and hectic perſons they more eſpecially are.

Thus we may, without the aſſiſtance of the new chyle entering into the veſſels, account for that inclination to ſleep, which follows upon a full ſtomach; though we muſt alſo allow the diſtenſion from this to be a conſiderable cauſe of the ſame effect. But this does not happen immediately, nay, ſometimes perhaps not within two or three hours after eating: and therefore the ſudden drowſineſs muſt (as well as the preſent refreſhment and reviving which meat gives) be chiefly owing to ſome more ſpeedy alteration.

We come then, in the next place, to opium itſelf; the chemical analyſis of which, out of ſix ounces, afforded, of a volatile alcaline ſpirit, not very unlike to that drawn from hartſhorn, two ounces; of fœtid oil, five drachms, one ſcruple, ſixteen grains; of coal, void of ſalt, two ounces, two drachms, one ſcruple, four grains.

The virtues therefore of opium are owing to a volatile alcaline ſalt, intimately mixed and combined with an oily, ſulphureous ſubſtance: the effects of which we muſt conſider, firſt of all upon the ſtomach, and afterwards, when they have paſſed the primæ viæ, upon the arterial fluid itſelf.

An agreeable ſenſation produced in the ſtomach, together with a diſtenſion of its membranes, we obſerved before to be the cauſe of that ſleepineſs to which we are ſo prone after eating. The one of theſe engages the mind, the other acts upon the body. For pleaſure amuſes the ſoul, as it were, ſo that it does not think, or exerciſe itſelf about any outward objects; that is, is inclined to reſt. And the fulneſs of the veſſels in the brain checks and hinders, in ſome meaſure, the derivation of the nervous juice into the organs, &c.

Now they who take a moderate doſe of opium, eſpecially if not long accuſtomed to it, are commonly ſo tranſported with the pleaſing ſenſe it induces, that they are, as they oftentimes expreſs themſelves, in heaven: and though they do not always ſleep, (which proceeds from the preſentation of pleaſing images to the mind being ſo ſtrong, that like dreams they over-engage the fancy, and ſo interrupt the ſtate of reſt), yet they however enjoy ſo perfect an indolence and quiet, that no happineſs in the world can ſurpaſs the charms of this agreeable ecſtaſy.

Thus we have from this medicine, but in a far more eminent degree, all thoſe effects which we obſerved to follow upon that grateful ſenſe in the ſtomach which a moderate fulneſs produces. For no bodies are ſo fit and able pleaſingly to affect our ſenſile membranes, as thoſe which conſiſt of volatile parts, whoſe activity is tempered and allayed by the ſmoothneſs of ſome lubricating and oily ones: which, by lightly rarefying the juices of the ſtomach, and cauſing a pleaſant titillation of its nervous coat, will induce an agreeable plenitude, and entertain the mind with ideas of ſatisfaction and delight.

The caſe being thus, we eaſily ſee upon what mechaniſm the other virtues of opium depend, its eaſing pains, checking immoderate evacuations, &c. not only in that the mind being taken up with a pleaſing ſenſe, is diverted from a diſagreeable one; but all pain being attended with a contraction of the part, that relaxation of the fibres which it now cauſes, eludes and deſtroys the force of the ſtimulus.

In like manner, in immoderate ſecretions there is moſt commonly an irritation of the organs, the removal of which will abate the diſcharge. And herein lies the incraſſating quality of this medicine, in that the twitching ſenſe upon the membranes of the lungs, bowels, &c. being now leſſened, the ſharp humour is ſuffered to lodge there in a greater quantity, before it is ſo troubleſome as to be thrown off and expelled: it being all one as if there were no irritation of the part, if the uneaſy ſenſe thereof be not regarded by the mind.

Theſe effects will all be heightened by the mixture of the opiate particles with the blood; which is hereupon rarefied, and diſtends its veſſels, eſpecially thoſe of the brain: and this does ſtill to a greater degree leſſen the influx of the nervous fluid to the parts, by preſſing upon the little tubuli, or canals, through which it is derived.

This is the reaſon of that difficulty of breathing which they for a time experience, who take this kind of medicine, this ſymptom being inſeparable from the rarefaction of the blood in the lungs.

From hence it appears, that the action of opium is very analogous to that of other volatile ſpirits, only that a ſmall portion of it has a force equal to that of a greater quantity of moſt of them.

This is very evident in thoſe who accuſtom themſelves to take large doſes of it; as the Turks and Perſians do to that degree, that it is no uncommon thing there to eat a drachm or two at a time: for the effects of it in them are no other than downright drunkenneſs; upon which account * it is as common

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* Vid. Belon. voyag. lib. iii. c. 15.

a ſaying with them, and on the ſame occaſion, "He "has eat opium;" as with us, "He has drank too "much wine."

Neither indeed do they otherwiſe bear ſuch large quantities of it, than our tipplers will a great deal of brandy; that is, by habituating themſelves to it by degrees, beginning with ſmall doſes, and requiring ſtill more and more to raiſe themſelves to the ſame pitch. Juſt as Galen * tells us of a woman at Athens, who by a gradual uſe had brought herſelf to take, without any hurt, a conſiderable quantity of cicuta, or hemlock. Which inſtance is the more to our purpoſe, becauſe Nic. Fontanus † knew one, who being recovered of the plague, and wanting ſleep, did, with very good effect, eat hemlock for ſome time; till falling ill again of a fever, and having left off the uſe of this remedy, he endeavoured to procure reſt by repeated doſes of opium, which (nature having been accuſtomed to a ſtronger alterative) had no operation, till the help of cicuta was again called in with deſired ſucceſs.

It is a ſufficient confirmation of all this reaſoning, that Proſper Alpinus ‡ obſerved among the Egyptians, thoſe who had been accuſtomed to opium, and were faint and languid through want of it, (as drinkers are if they have not their liquor), to be recovered, and put into the ſame ſtate of indolence and pleaſure, by large doſes of Cretic wine made hotter by the infuſion of pepper, and the like ſtrong aromatics.

Nor is it perhaps amiſs to remark, that in maniacal

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* Simpl. medicam. facult. lib. iii. c. 18. † Reſponſ. et curat. medic. p. 162. † Medicin. Ægypt. lib. iv. c. 1.

cal people, as is frequently obſerved, a quadruple doſe of opium will ſcarce produce any conſiderable effect. Now, in perſons ſo affected, the mind is deeply engaged, and taken up with ſome images, or other, as love, anger, &c. ſo that it is not to be ſo eaſily moved or diverted by thoſe pleaſing repreſentations, which it would attend to at another time, and upon which the virtues of this medicine in a great meaſure depend. Beſides this, thoſe who are maniacal do to a wonder bear the injuries of cold, hunger, &c. and have a prodigious degree of muſcular force; which argues the texture of their blood to be very ſtrong, and the coheſion of its globules great: ſo that the ſpirituous parts of the opiate cannot make that disjunction and rarefaction of this fluid in them, which it does in ordinary bodies and conſtitutions.

Many are the improvements which might be made of this theory, with relation to the practice of phyſic: but theſe will be obvious enough to one inſtructed in the animal œconomy.

I cannot, however, omit two uſeful remarks from it. The firſt is, that by not underſtanding the manner in which this noble medicine acts, when it checks immoderate ſecretions, phyſicians are often led into wrong methods, and give it to ſtop thoſe evacuations in which there are no ſpaſms or painful irritations; as particularly, in colliquative diarrhœa's attending hectic fevers: whereas, it is manifeſt, it muſt in ſuch caſes (without the deſired effect) do real miſchief, by relaxing the fibres, and heating and rarefying the fluids, already too thin and broken in their texture.

And, on the other hand, it is eaſily ſeen, that this ſame property, by which it takes off cramps in the nerves, and thus cures excretions depending upon them, will very often happily promote thoſe diſcharges which are natural, when they are unſeaſonably interrupted by violent contractions. Thus opiates, in nephritic pains, move the urine ſtopped by gravel and ſtones; and, in uterine caſes, aſſiſt nature in propelling the menſes, the fœtus, and the lochia.

To conclude then, it is very plain, that there needs no more to make opium prove deſtructive or a poiſon, than to take too great a quantity of it: for then it muſt inflame the ſtomach, and rarefy the blood to ſuch a degree, that the veſſels cannot again recover their tone; whereupon apoplectic ſymptoms, &c. will enſue.

To be convinced of this, I forced into the ſtomach of a ſmall dog about half a drachm of crude opium diſſolved in boiling water. He quickly vomited it up with a great quantity of frothy ſpittle; but repeating the trial, by holding up his head, and beating him, I made him retain three or four doſes, intermitting between each about a quarter of an hour. When he had thus taken, as I could gueſs, near two drachms, I watched him about an hour: then he began to ſleep, but preſently ſtarted up with convulſions, fell into univerſal tremblings, his head conſtantly twitched and ſhaking, he breathed ſhort and with labour, loſt entirely the uſe firſt of his hinder legs, and then of the fore ones, which were ſtiff and rigid like ſticks. As he lay ſnorting, to haſten his end, I was giving him more of the ſolution; but on a ſudden his limbs grew limber, and he died.

Opening his ſtomach, I found it wonderfully diſtended,

tended, though empty of every thing but ſome water and opium; parcels of frothy mucus ſwimming in it; the inſide was as clean as if ſcraped and waſhed from all the ſlime of the glands, with ſome redneſs here and there, as in a beginning inflammation. The pylorus was contracted. The blood-veſſels of the brain were very full: and I took out a large grume of concrete blood from the upper part of it, cutting into the ſinus longitudinalis, as is not uncommon in apoplectic carcaſes; but found no extravaſated ſerum in the ventricles, nor among any of the membranes.

As to the cure in ſuch caſes; beſides emptying by vomiting, bleeding, and bliſtering, acid medicines and lixivial ſalts are the proper remedies. Theſe contract the relaxed fibres, and by their diuretic force make a depletion of the veſſels. I have particularly, with extraordinary ſucceſs, given repeated doſes of a mixture of ſalt of wormwood with juice of lemons. This is the foundation upon which Van Helmont prepared his laudanum cydoniatum, and Starkey his pacific pill. Generous wine, which the ancients gave for an antidote, can be no otherwiſe uſeful, than as it diſſolves the reſinous clammy part of the opium ſticking to the coats of the ſtomach, and ſo forwards its expulſion by other helps, which cauſe a contraction of the muſcular fibres.

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AS an appendix to this diſcourſe, I ſhall ſubjoin an account of another poiſon, very different from any we have deſcribed, but nearly related to thoſe called *narcotic*.

This is the ſimple water diſtilled from the leaves of the laurocerafus, or common laurel: the bad effects of which were firſt obſerved ſome years ſince in Ireland; where, for the ſake of its flavour, it was frequently mixed with brandy.

A ſmall quantity of this killed two women who drank it, very ſuddenly. Hereupon a learned phyſician, ſurpriſed at the event, (this plant having never been thought to be any wiſe noxious), made ſeveral experiments with it upon dogs, which were afterwards, ſome of them, repeated here, with the ſame fatal ſucceſs *.

From all theſe, but more particularly from obſervations communicated to me by Dr Nicholls, (which he had made in his anatomical lectures), I ſhall give a ſhort deſcription of the appearances in the animals put to death in this uncommon way.

All the dogs fell immediately into totterings and convulſions of the limbs, which were preſently followed by a total paralyſis, ſo that no motion could be excited even by pricking or cutting them.

No inflammation, upon diſſection, was ſeen in any of the internal membranes. The moſt remarkable thing was, a great fulneſs and diſtenſion of the veins, in which the blood was ſo fluid, that even the lymph in its veſſels was generally found tinged with red.

The ſame water, injected, as a clyſter, into the inteſtines, had always the like effects, in a very few minutes.

To make the manner of acting of this poiſon more evident, Dr Nicholls prepared a quantity of it much ſtronger than ordinary, by cohobating, (as the chemiſts call it), or diſtilling it twice from freſh leaves.

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* Vid. Philoſoph. Tranſact. N° 418. and 420.

By this proceeding he had about a drachm of a heavy oil, of the colour of olive oil, ſubſiding at the bottom of about three pints of water: this, by frequent ſhaking, was quite incorporated again with the water.

About two ounces of this killed a middle-ſized dog, in leſs than half a minute, even while it was paſſing down the throat.

I do not know a more convincing proof of what I have all along affirmed, that all poiſons act principally upon the nervous fluid, than this ſeemingly innocent water gives us. That a ſimple liquor, without any extraordinary ſenſible qualities, ſhould even in its paſſage into the ſtomach, nay when thrown into the lower guts as a clyſter, inſtantaneouſly kill, and that without any marks of inflammation or corroſion, can no other way be accounted for, but by an immediate effect upon the animal ſpirits.

If what I have, in the introduction, conjectured concerning the nature of the nervous fluid, be right; the elaſtic matter, which enters into its compoſition, muſt in the membranes ſuffer a repulſion from ſome active particles in this water; (as we ſee in many experiments of electricity, it is in this manner affected by ſeveral bodies meeting with it): in conſequence of which, the nerves, firſt of the membranes which it touches, and then of all the organs, muſt loſe their action. Hence it is that animals killed this way, after ſtrong convulſions, die univerſally paralytic: and a ſudden ſtop being put to the circulation, the blood remains in perfect fluidity in the veins.

More will be ſaid to this purpoſe in the following eſſay. I ſhall only add here, that the deadly power of this water ſeems to be entirely owing to its being over-ſaturated with that heavy oil which we have mentioned; and therefore Dr Nicholls experienced, that ten drops of a red oil, (like to this, of a kernelly flavour and taſte), diſtilled in the ſame manner from bitter almonds, (after the ſweet oil had been expreſſed), mixed with an ounce of common water, in like manner, killed a dog in about half an hour.

Conſidering all this, and that it would be a confirmation of what I have aſſerted, if the application of ſuch ſubſtances as draw back the ſpirits to their membranes, ſhould, by an irritating force, contrary to the repelling liquor, revive the dying animal; we gave to a ſmall dog about an ounce of ſtrong laurel-water. He fell immediately into moſt violent convulſions, which were ſoon followed by a total loſs of his limbs. When he ſeemed to be expiring, we held to his noſtrils a phial of good ſpirit of ſal ammoniac, and forced a ſmall quantity of the ſame down his throat: he inſtantly felt its virtue, and, by continuing the uſe of it for ſome time, by degrees recovered the motion of his legs; and, in about two hours, walked about with tolerable ſtrength, and was afterwards perfectly well.

The antidote ſhews the nature of the poiſon; and I make no doubt but the ſame will prove effectual againſt any others of this kind, which, without an inflaming quality, ſtupefy, and ſtop the motion of the nervous fluid.

I give this hint, becauſe it is well known, that the kernels of ſome fruits, particularly of black cherries, afford by diſtillation a water, in taſte and ſmell, not unlike to that from laurel or bitter almonds: which, if drawn off very ſtrong, or over-impregnated with the heavy oil, may certainly cauſe the like bad ſymptoms. Some trials, as I am informed, have proved this to be ſo. Upon this account, I think our ſhops had better be without this water; eſpecially ſince it is not known to have any medicinal virtue, and is commonly given to infants, eaſily affected, and ſubject to convulſions, the very diſorder which waters of this kind have been found to produce.

ESSAY VI.

Of VENOMOUS EXHALATIONS from the EARTH, POISONOUS AIRS, and WATERS.

BEſides theſe already treated of, there is yet another way of being poiſoned; and that is by venomous ſteams and exhalations, or a poiſonous air taken into the body by the breath.

This is notorious enough, and authors upon many occaſions make mention of it; but when they come to explain the particular manner how this kills, they moſt commonly reduce it to ſome of the poiſons, which prove deſtructive by being admitted into the ſtomach: alleging that malignant fumes and airs are therefore fatal, becauſe impregnated with arſenical, mercurial, and the like hurtful μιάσματα or particles, they convey theſe into the body; which being of a very corroſive nature, muſt neceſſarily do hurt both to the fluid and ſolid parts.

And indeed that the fumes of theſe ſame minerals are very pernicious, and air filled with their atoms very unfit for reſpiration, is moſt certain; but to argue from hence, that all deadly vapours and malignant airs owe their miſchief to theſe only, is too fond and ill-grounded a conceit: ſince upon a due inquiry it will appear, that there may be, and are, mortiferous exhalations from the earth, infecting the air, of a nature ſo different from any of thoſe poiſons, that the very ſubſtance from which they ariſe, may not be at all hurtful, though taken into the ſtomach itſelf.

Venomous ſteams and damps from the earth the Latins, in one word, called *Mephites* [*].

This, as many other Tuſcan words, comes from a Syriac theme, which ſignifies to blow or breathe [†]. And in ancient times ſeveral places were remarkable for them: ſo the Mephitis of Hierapolis was very famous, of which Cicero, Galen, but more particularly, and from his own ſight and knowledge, Strabo [‡] makes mention.

Such another was the Specus Corycius in Cilicia, which, upon the account of its ſtinking deadly air, ſuch as is thought to proceed from the mouth of dragons, which the poets give to Typhon, was called *Cubile Typhonis*. This Pompon. Mela [||] deſcribes; and it is indeed as ancient as Homer [ǂ]: for Arima, in which he places it, was, as Euſtathius obſerves, a mountain of Cilicia.

Neither are ſuch fumes as theſe now infrequent; and though moſtly found in mines, pits, and other ſubterraneous places, yet they are ſometimes met with on the ſurface of the earth too, eſpecially in countries fruitful of minerals, or pregnant with imbowelled fires: ſuch are Hungary and Italy, which latter, as Seneca * takes notice, has always been remarkable for them.

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[*] Virgil. Æn. vii. v. 84. ——— Sævamque exhalat opaca mephitim. Vid. Servium, ibid.

[†] Scaliger, conject. in Varron.

[‡] Lib. xiii.

[||] De ſitu orb. lib. i. c. 13.

[ǂ] Εἰν Ἀρίμοις ὅθι φασὶ Τυφώεος ἔμμεναι εὐνάς. Il. β. ver. 783.

I ſhall therefore, having had the opportunity of making ſome remarks upon one of the moſt famous of all in thoſe parts, give as good an account as I can of that, and its manner of killing; which though I dare not affirm to be applicable to every Mephitis, yet ſeems plainly to be the caſe of moſt of them: and where it is not, this ſimple miſchief will only be found to be complicated with another; and then ſome extraordinary ſymptoms, or appearances in the animals killed, will eaſily make a diſcovery of the additional venom and malignity.

This celebrated Mofeta, taken notice of (or at leaſt ſome other hereabouts) even in the time of Pliny †, is about two miles diſtant from Naples, juſt by the Lago d' Agnano, in the way to Pozzuolo or Puteoli, and is commonly called la Grotta de' Cani: becauſe the experiment of its deadly nature is frequently made upon dogs; though it be as certainly fatal to any other animal, if it come within the reach of its vapour. For Charles VIII. of France proved it ſo upon an aſs; and two ſlaves put into it by order of D. Pietro di Toledo, viceroy of Naples, with their heads held down to the earth, were both killed ‡.

It is a ſmall grotto at the foot of a little hill, a-

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* Nat. Quæſt. l. vi. c. 28. † Nat. Hiſt. lib. ii. c. 93. ‡ L. di Capoa delle Mofet. p. 37.

bout eight feet high, twelve long, and ſix broad. From the ground ariſes a thin, ſubtile, warm fume, viſible enough to a diſcerning eye, which does not ſpring up in little parcels here and there, but is one continued ſteam, covering the whole ſurface of the bottom of the cave; and has this remarkable difference from common vapours, that it does not, like ſmoke, diſperſe itſelf into the air, but quickly after its riſe falls back again, and returns to the earth; the colour of the ſides of the grotto being the meaſure of its aſcent: for ſo far it is of a darkiſh green, but higher only common earth, and this is about ten inches. And therefore, as I found no inconvenience by ſtanding in it, ſo no animal, if its head be kept above this mark, is in the leaſt injured. But when (as the manner is) a dog, or any other creature, is forcibly held below it, or by reaſon of its ſmallneſs cannot hold its head above it; it preſently, like one ſtunned, loſes all motion, falls down as dead, or in a ſwoon, the limbs convulſed and trembling, till at laſt no more ſign of life appears, than a very weak and almoſt inſenſible beating of the heart and arteries: which, if the animal be left there a little longer, quickly ceaſes too; and then the caſe is irrecoverable, as in one perfectly ſtrangled. But if it be taken out in time, and laid in the open air, it ſoon comes to life again; and ſooner, if thrown into the adjacent lake, which by conſtringing the fibres of the ſkin, in the manner of a cold bath, puts the blood again into its circulation.

It will afford ſome light towards the knowledge of the nature of this fume, to mention ſome other experiments made in the grotto *. A lighted torch,

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* Addiſon's remarks on Italy, p. 230.

ſnuff and all, goes out in a moment, when dipped into the vapour.

A piſtol cannot take fire in it. If a weather-glaſs be ſo fixed in the grotto, that the ſtagnum is wholly covered with the vapour, the quickſilver neither falls nor riſes otherwiſe than in the outward air.

In this ſhort, but accurate hiſtory of this grotto, I have ſet down thoſe particulars which not only diſtinguiſh mephitical exhalations from common and innocent fumes, but alſo give hints ſufficient, I think, to determine the reaſon and manner of their ſurpriſing effects.

And not to ſpend time in refuting the opinion of others, I firſt take notice, that here can be no ſuſpicion of any ſuch poiſon as we have deſcribed: if there was, animals taken out of the grotto could not ſo immediately recover from the effects of it, without any remaining appearance of faintneſs and ſickneſs, or ſuch ſymptoms as are ſuffered from inſpiring air impregnated with corroſive effluvia; and theſe would certainly, in ſome degree at leaſt, infect the air in the upper part of the cave, which is always pure and fit for reſpiration. Neither could a miſchief of this kind be produced, without ſome marks of it in the creatures killed, when opened: which yet diſcover nothing extraordinary, either in the fluid or ſolid parts, except what I ſhall preſently mention in frogs.

In order therefore to underſtand wherein this deadly power conſiſts, it muſt be obſerved, that the uſe of reſpiration is twofold; the firſt, that the blood, in its paſſage through the lungs, may by the elaſticity of the air, diſtending the veſiculæ, and thus preſſing upon the arteries *, be comminuted and broken, ſo that no coheſion of its parts may hinder the ſecretion of thoſe humours which in the ſeveral glands are to be derived from it: the other is, that the blood may be ſupplied with ſomething from the air, whatever it be, neceſſary to life.

That there is a vivifying matter from the air, which paſſes into the blood by the breath, I have in another place † demonſtrated, by obſerving, that the ſame quantity of it will not ſuffice long for breathing, though it be deprived of none of thoſe qualities, by which it is fitted to inflate the lungs, and agitate the blood. And likewiſe, from the experiment of Dr Halley, who, when ſeveral fathom under water, in his diving engine, breathing an air more condenſed than the natural, found that he drew his breath more ſlowly than uſual: the reaſon of which muſt be this, that when a greater quantity of air than ordinary was taken in at a time, and conſequently the blood furniſhed with more of thoſe particles which are neceſſary to be mixed with it, a leſs frequent reſpiration ſufficed.

The caſe being thus, ſince (as we have mentioned) the mercury in the barometer is not altered in its aſcent by this vapour, that is, there is no want of gravity and elaſtic preſſure in it, at leaſt not to a conſiderable degree; we muſt conclude, that there is ſome quality in it, which, when it is drawn into the lungs, prevents and ſtops the uſual communication of the enlivening ſpirit from the air to the blood.

We have already taken notice, that there can be no

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* Vid. Malpigh. de pulmon. & Bellin. opuſcula.

† Diſcourſe on the plague, edit. 9. p. 45.

real poiſon here. All that is diſcovered by the earth from which the fume ariſes, is no more than that it is of a greeniſh colour, with a ſubacid taſte, very much (as L. di Capoa obſerves) like to that of the phlegm of vitriol: ſo that it may very well be called an unctuous vapour, of the vitriolic kind, raiſed by a ſubterraneous heat.

It is certainly neceſſary to the inflation of the pulmonary veſiculæ, and the ſubſequent entrance of the ſubtile matter from the air into the blood, that the nervous liquor ſhould have a free courſe into them: it is therefore highly probable, that theſe vitriolic particles in the fume have a counteraction or repulſive force to the elaſtic matter of this liquor; by means of which the fibrillæ, into which it ſhould paſs, being deſtitute of it, become quite relaxed and loſe their force *.

Neither muſt it ſeem ſtrange, that the animal ſpirits ſhould be ſo ſuddenly interrupted in their action, by the interpoſition of a ponderous fluid; ſince we ſee every day how inſtantaneouſly, on the other hand, their motion is quickened and revived by the application, to the noſtrils, of volatile ſalts: and it may be obſerved, that theſe are always alcaline, that is, of a nature quite oppoſite to vitriolic or acid ſpirits, ſo as readily to fall into a conflict or fermentation with them.

To conclude this part of our diſcourſe; I think it a ſufficient confirmation of this reaſoning, that in frogs killed in this grotto, the bladders of the lungs (more viſible otherwiſe and diſtinct in theſe creatures than in moſt other) were found ſubſided and quite empty of

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* Vid. eſſay v. at the end.

air *. But if any one deſires a farther proof, he may, according to theſe principles, make, as L. di Capoa did †, an artificial mephitis: for if antimony, biſmuth, or any other ſuch mineral, be finely powdered, and moiſtened with aqua fortis, or ſpirit of nitre; there will ariſe a great heat, with a thick dark ſmoke, in which, as in this grotto, torches are extinguiſhed, and animals, though but ſlowly, ſtifled and killed.

The mortal effects of ſubterraneous damps, in mines, deep wells, and the like cloſe places; as alſo of the fumes of confined burning charcoal, may be accounted for in the ſame way; theſe being generally acid exhalations from mineral ſubſtances ‡. And as in animals which have died in the deſcribed grotto, the veſicles of the lungs are found ſubſided, wanting due tenſion from the animal ſpirits; ſo in the diſſection of a man killed by the vapour of wood coals, carried from a baker's oven into a deep cellar, as the ſtory is related in the memoirs of the royal academy at Paris ‖, the brain appeared dry, and the muſcles of the arms and thighs ſo relaxed, that they ſeemed ſeparated from the parts to which they belonged.

But it muſt here be obſerved, that, in ſome caſes of this nature, the mineral particles are mixed with ſo ſmall a proportion of water, that, inſtead of extinguiſhing a flame, they will themſelves, like gunpowder, take fire, and burn at the approach of a candle. A famous inſtance of ſuch a vapour is given in our Philoſophical Tranſactions +: and an experiment, made by a mixture of oil of vitriol and filings of

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* L. di Capoa, Moſet. p. 40. † Ibid. p. 128.

‡ Vid. Philoſ. Tranſ. N° 411. & 429. ‖ Ann. 1710. p. 17. + N° 442.

iron, confirms the truth of our reaſonings on this head.

Thus I have ſhewn how death may enter at the noſtrils, though nothing properly venomous be inſpired. It might perhaps be no difficult matter to ſhew, how a leſſer degree of this miſchief may produce effects, though ſeemingly very different from theſe now mentioned, yet in reality of the ſame pernicious nature: I mean, how ſuch an alteration of the common air, as renders it in a manner mephitical, (which is done by too much heat, and at the ſame time too great a proportion of watery and other groſſer particles mixed with it), may be the cauſe of epidemic diſeaſes, and, it may be, more eſpecially of thoſe which, by reaſon of their untoward ſymptoms, are uſually called malignant.

For it is very remarkable, that Hippocrates * obſerved the conſtitution of the air which preceded peſtilential fevers, to be great heats, attended with much rain and ſouthern winds: and Galen † takes notice, that no other than a moiſt and hot temperament of the air brings the plague itſelf; and that the duration of this conſtitution is the meaſure of the violence of the peſtilence. Lucretius ‡ is of the ſame mind: for in his admirable deſcription of the plague of Athens, " Theſe diſeaſes" (ſays he) " either come " from the air, or ariſe from the earth,"

——— *Ubi putrorem humida nacta eſt*
Intempeſtivis pluviiſque et ſolibus icta.

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* Epidem. lib. ii. & iii. † De temperament. lib. i. c. 4. & commentar. in epidem. lib. iii. ‡ Lib. vi. ver, 1099.

In ſhort, the general hiſtories of epidemic diſtempers almoſt conſtantly confirm thus much; and would have done it more, if the vain notion of occult venoms had not prepoſſeſſed the minds of authors, and made them regardleſs of the manifeſt cauſes.

And this is notorious enough in thoſe countries where malignant diſeaſes are moſt rife: thus it is a very common obſervation in the Eaſt Indies, that during the dry heats the ſeaſon is healthful, but when the rains fall immediately upon the hot weather, then untoward fevers begin to threaten.

The ſame is obſerved in Africa: for (as Joan. Leo * relates) if ſhowers fall there during the ſultry heats of July and Auguſt, the plague and peſtilential fevers enſue thereupon, with which whoſoever is infected hardly eſcapes.

Whoever reflects on what has been ſaid of the uſe of reſpiration, and conſiders the propoſitions of Bellini, will eaſily underſtand the reaſon of theſe events.

This great demonſtrator has proved, that malignant and peſtilential fevers are owing to a viſcid and tenacious lentor or ſlime, which firſt obſtructs the capillary arteries, and afterwards, being diſſolved by heat, ferments with the blood, and changes it to a maſs unequally fluid and glutinous.

Now it is plain, that air, together hot and moiſt, not having force ſufficient to comminute the arterial fluid in the lungs, this, when it arrives at the ſecretory organs, will, inſtead of deriving into them their proper liquors, leave its moſt viſcid parts ſticking about their orifices, which by degrees make obſtructions. Theſe

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* Hiſt. Afric. lib. 1. c. 1. Vid. Purchas's pilgrims, book vi. c. 1. Dapper, deſcriptio Afric. p. 127.

can only be removed by the impetus of the ſucceeding blood, and the agitation of heat; and then this ſlimy mucus, being again taken into the circulation, will, in the nature of a ferment, diſturb the whoſe maſs, and alter its natural properties.

I very well know, that the authority of Hippocrates is brought to ſupport the fancy of a latent aereal poiſon in ſome of theſe diſtempers: his Θεῖόν τι, (ſomething divine *) is conſtrued in this ſenſe. But his beſt interpreter, Galen, underſtood by this expreſſion no ſuch thing as they mean: on the contrary, he ſays, it is a manifeſt conſtitution of the air, prevailing unſeaſonably, ſuch as himſelf has deſcribed in his Aphoriſms †; and which is the ſame with that of which we are diſcourſing.

Minadous ‡ therefore rightly remarks, that, in his whole epidemics, Hippocrates never once mentions any venom as the cauſe of malignant diſeaſes; and, as to any thing really divine, the wiſe old man in other treatiſes ‖ expreſsly teaches, "That no diſeaſe comes "from the gods, one more than another, each ac- "knowledging its own natural and manifeſt cauſe."

But it is foreign to our purpoſe to enlarge on this ſubject. I ſhall only hint, that phyſicians ought therefore to be very cautious in giving, as they often do in caſes of this nature, under the notion of alexipharmacs, ſuch medicines as raiſe a great heat both in the ſtomach and blood. Having engaged the animal ſpirits in war with malignities, they too often ſend treacherous auxiliaries to the ſuppoſed weak party;

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* Vid. prognoſtic. & Galen. comment. † Sect. iii. aph. 11. ‡ De febre malign. lib. i. c. 8. ‖ De aëre, aquis, & locis; & de morbo ſacro.

and, by exciting new tumults and diſorders, check and interrupt the work of nature, which always endeavours to conquer its enemy by critical diſcharges.

It muſt indeed be owned, that ſome malignant fevers are contagious, and that contagion is a real poiſon: but the original cauſe of a diſeaſe, and the communication of it, are very different things. Of this I have largely diſcourſed on another occaſion *: I ſhall therefore only hint here, that when a fever is communicated by way of infection from one already diſeaſed, this moſt commonly happens at the latter part of the diſtemper; that is, (as was obſerved in the hydrophobia), when the fermenting blood is throwing off great quantities of its active particles upon the glands of the moſt conſtant and eaſy ſecretions: ſuch are thoſe in the ſurface of the body and the mouth. Theſe therefore being by the air drawn into the lungs of a ſound perſon, and likewiſe inſinuating themſelves into the pores of the ſkin, will affect firſt the nervous fluid, and then the blood, and produce the like fermentation and diſorder, which had been bred in the body from which they aroſe.

The way by which bad food, ill-ripened fruits of the earth, &c. do often produce malignant and peſtilential diſeaſes, is not very different from that by which we have obſerved unwholeſome airs to be the cauſe of the like effects. For the juices, with which thoſe ſupply the blood, being corrupted, muſt neceſſarily make a fluid neither fit for nutrition nor the animal ſecretions: and it is therefore no wonder, if, beſides the other ſymptoms enſuing, ſore puſtules, inflammations, ulcers, &c. (more common in fevers

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* Diſcourſe on the plague.

from this cauſe than in any other), are raiſed in the ſurface of the body.

It is upon this account, that a famine is very often ſucceeded by a peſtilence. And this calamity generally begins among the poorer ſort of people, whoſe diet to be ſure is the worſt.

It is a conſtant obſervation in countries ſubject to the plague, as Turky and Africa, that when the common inhabitants die in great numbers, foreigners who live in plenty, if they avoid communication with the infected, eſcape the danger.

Thus much concerning poiſonous exhalations and airs, ſo far as the conſideration of the Grotta de' cani has led us on to inquire into their effects. For though there may be other alterations of this ſame element, differing in their nature from this we have inſiſted upon, and yet equally pernicious and hurtful; yet we take no notice of any of them, in regard that thoſe which are from arſenical, mercurial, and the like fumes, are reducible to a foregoing eſſay: and thoſe which are owing to a change of the known properties of the air, may be eaſily explained, by what has been already delivered in this. I ſhall therefore rather chuſe to make ſome remarks on the miſchief of another fluid, which as it is the next in uſe to this we have been treating of, ſo the bad qualities of it, when it comes to be altered, muſt neceſſarily be almoſt equally fatal and dangerous.

I mean water, which is of ſo conſtant ſervice, not only for our drinks, but alſo in preparing of our fleſh and bread, that it may juſtly be ſaid to be the vehicle of all our nouriſhment: ſo that whenever this happens to have other properties than are neceſſary to fit it for this purpoſe, it is no wonder if in its paſſage through the body theſe make ſuitable impreſſions there.

Thus at Paris, where a part of the city is ſupplied with a water from Arcueil, which is ſo full of ſtony particles, that even the pipes, through which it runs, are in time incruſted and choked up; Dr Liſter has obſerved, that the inhabitants are more ſubject to the ſtone in the bladder, than in moſt other places *.

In like manner, let the groſs particles with which the water is ſaturated, be of any other nature, metallic, ſaline, &c. theſe, according to their various gravity, the capacity of canals, and ſuch like circumſtances, will, when they come to circulate in the animal body, be by the laws of motion depoſited in one part or other. So thoſe mineral bodies, and nitrous ſalts, which abound in the ſnowy waters of the Alps, do ſo certainly ſtuff and enlarge the glands of the throat in thoſe who drink them, that ſcarce any who live there are exempted from this inconvenience †.

For this reaſon, the choice of water for drink among the ancients was by weight, the lighteſt being preferred, as moſt free from all heterogeneous bodies.

The caſe therefore of poiſonous ſprings is, their having corroſive corpuſcles mixed with their water, which cannot fail, when forſaken of their vehicle in the canals of the body, to do the ſame miſchief as they would, if taken by themſelves undiluted: only with this difference, that they may in this form be carried ſometimes farther into the animal œconomy, and ſo, having paſſed the primæ viæ, diſcover their

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* Vide Liſter's journey to Paris. † *Quis tumidum guttur miratur in Alpibus?* Juvenal. ſatir. xiii.

malignity in ſome of the inmoſt receſſes. Thus the fons ruber in Æthiopia, mentioned by Pliny *, about which abundance of native minium or cinnabar was found, ſhewed its ill effects chiefly on the brain: and therefore Ovid † ſays of it,

——— *Si quis faucibus hauſit,*
Aut furit, aut patitur mirum gravitate ſoporem.

We ſhall not need then to enlarge on this matter; ſince any of the forementioned mineral poiſons may thus impart their deadly quality to waters: and accordingly there are inſtances of arſenical, mercurial, &c. fountains, of which the hiſtories may be ſeen in the collections of the learned Baccius ‡; and one very remarkable in the Philoſophical Tranſactions ‖.

But as we before took notice concerning airs, ſo it may be worth the while to obſerve of waters, that there are ſome alterations of them, which though not properly poiſonous, yet are of ſo great conſequence in their effects, that they may very well deſerve to be regarded.

This I ſhall do with reſpect to a great abuſe committed in this kind about the city; and that is, in chuſing ſometimes ſtagnating impure well-water for the brewing of beer, and making other drinks. Such a fluid indeed has oftentimes a greater force and aptneſs to extract the tincture out of malt, than is to be had in the more innocent and ſoft liquor of rivers: but for this very reaſon it ought not, unleſs upon mere neceſſity, to be made uſe of; this quality being owing to the mineral particles and aluminous ſalts with which it is impregnated.

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[*] Lib. xxxi. c. 2. [†] Metamorph. lib. xv. ver. 320. [‡] De therm. lib. vi. [‖] Number 8.

A late author[*], by ſearching into the firſt accounts of the diſtemper we call the ſcurvy, deſcribed by Pliny[†], and Strabo[‡], under the promiſcuous names of *ſtomacace* and *ſcelotyrbe*; and examining the authentic hiſtories of it in later years, made by the moſt obſerving phyſicians in thoſe countries where it was unhappily revived, as Olaus Magnus, Balduinus Ronſeus, J. Wierus, Solomon Albertus, &c. finds that the origin of it was in all times and places charged upon the uſe of unwholeſome ſtagnating waters. Then by comparing together the clayey ſtrata of the earth about the cities of London, Paris, and Amſterdam, he ſhews, that where the water is worſt, there this malady is moſt rife. So that he has put it out of all doubt, that moſt of the perplexed and complicated ſymptoms, which are ranged under this one general name, are in a great degree owing to the ill qualities of this element.

And indeed Hippocrates himſelf, as he has very plainly decyphered this diſeaſe[‖], by the title of σπλῆνες μέγαλοι, or great ſpleens; ſo he does very particularly in another treatiſe[⸸] take notice, that drinking of ſtagnating well-waters muſt neceſſarily induce an ill diſpoſition both of the ſpleen and belly.

If we inquire into the reaſon of ſuch ill effects, we muſt conſider, that clay is a mineral glebe, and that the groſs particles and metallic ſalts with which waters paſſing through ſuch a bottom abound, are, as Dr Liſter obſerves, not to be maſtered; that is, indigeſtible in the human body *. Not only therefore will theſe cauſe, as he very well argues, calculous concretions in the kidneys, bladder, and joints, and, as Hippocrates experienced, hard ſwellings in the ſpleen; but they muſt neceſſarily oftentimes by their corroſive quality twitch and irritate the ſenſile membranes of the ſtomach and bowels, and thus hinder and interrupt the digeſtion of our food. Nay, beſides all this, when they come into the blood, it is no wonder, if the ſmall canals of inſenſible perſpiration are frequently ſtopt and obſtructed by them: for it is upon this ſcore that Sanctorius † teaches us, "that heavy water converts the matter of tranſpiration into an ichor, which being retained induces a cachexy."

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[*] Dr J. H. ſcelera aquarum; or, A ſupplement to Mr Graunt on the bills of mortality.

[†] Lib. xxv. c. 3.

[‡] Geogr. lib. vi.

[‖] Prorrhet. lib. ii. c. 16.

[⸸] De aëre, aquis, et locis, ſub finem.

What miſchiefs will enſue hereupon, every one ſees; not only pains in the limbs, livid ſpots in the ſurface of the body, ulcers, &c. from the acrimony of the undiſcharged moiſture; but many beſides of thoſe nervous complaints, which go by the name of *hyſterical* and *hypochondriacal*, may take their riſe from the ſame ſource: for the before-cited Sanctorius ‡ has remarked, that the flatus or wind, ſo inſeparable from thoſe caſes, is no other than "the fluid of perſpiration rude and unfiniſhed."

If theſe inconveniencies are oftentimes not felt, at leaſt not till towards the declining age, in ſtrong and active habits of body; yet I am, from very good experience, aſſured, that they deſerve conſideration in weaker conſtitutions, and a ſedentary life, eſpecially of the more tender ſex.

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* De fontib. med. Angl. p. 2. pag. 75. At foſſilia ſive metallica ſalia alia atque alia ſunt, et nobis et pene igni dixeram indomabilia. † Medic. Static. § ii. aphor. 6. ‡ Ibid. § 3. aph. 13. Flatus nihil aliud eſt quam rude perſpirabile.

For theſe reaſons Pliny * tells us, "that thoſe "waters are condemned in the firſt place, which, "when boiled, incruſtate the ſides of the veſſels." And that our well-waters do this, no body who looks into the common tea-kettles, can be ignorant.

And indeed, in ancient times, as that part of medicine which relates to diet, was more carefully ſtudied, than it is now; ſo this point particularly, of which we are treating, was of ſo great moment, that Hippocrates, who wrote the beſt book † on the ſubject that ever was publiſhed, has in a great meaſure accounted not only for the diſeaſes, but even for the temper and diſpoſition of the people of ſeveral countries, from the difference of their airs and waters.

* Lib. xxxi. c. 3. Damnantur imprimis fontes, quorum aquæ decoctæ craſſis obducunt vaſa cruſtis. † De aëre, aquis, et locis.

Explication of figures not explained in the treatiſe.

TABLE III. The Scolopendra. Fig. 1. *aa*. The claws of the poiſoning forceps.

Fig. 2. One of the claws magnified, in which appears the aperture *b*.

Fig. 3. The Scorpion. *aa*. The claws. *b*. The tail with the ſting at the end.

Fig. 4. The ſting magnified, to ſhew one of the ſlits, out of which iſſues the poiſon *a*.

Fig. 5. The Tarantula. *aa*. The wounding forceps. *bb*. The feelers.

TABLE IV. Fig. 1. The upper part of an expanded leaf of the lichen. *aa*. The peltæ or ſeminal capſulæ, at the extremities of the leaves.

Fig. 2. The under-ſide of the ſame leaf, with the peltæ.

Fig. 3. A view of a leaf, as it lies on the ground unexpanded.

A

Fig. 4.

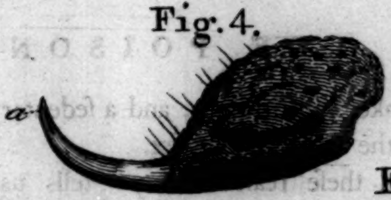


Fig. 1.

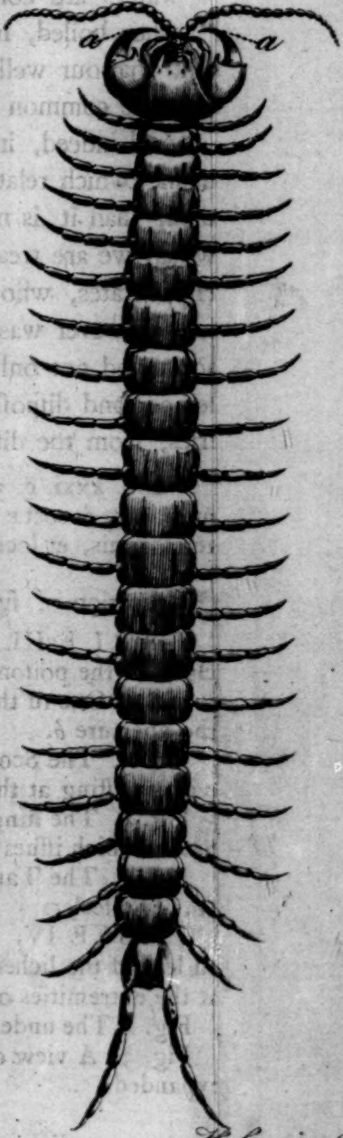


Fig. 3.

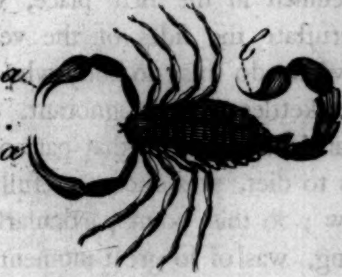
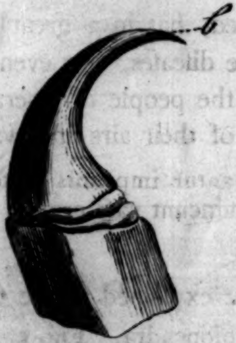


Fig. 2.



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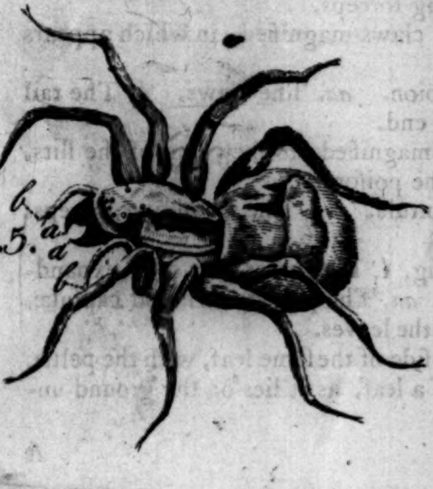

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Tab: IV.

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Fig. 1.

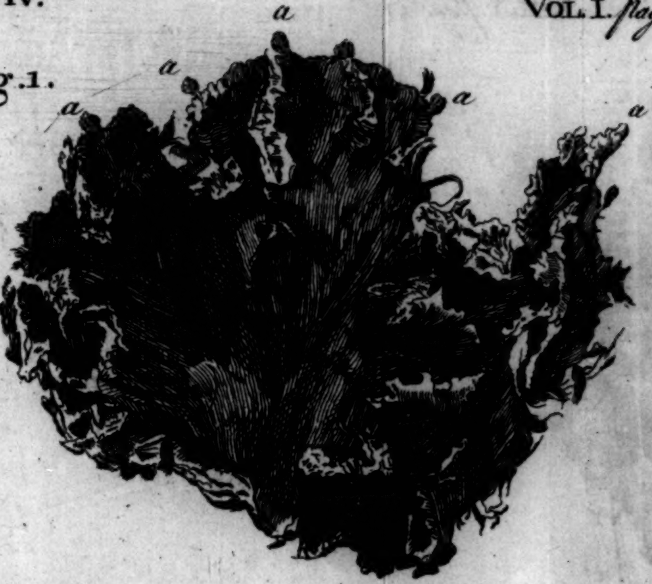


Fig. 3.

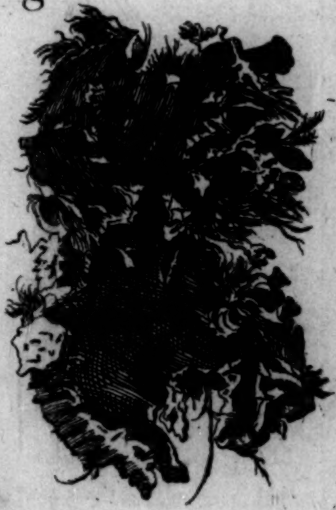
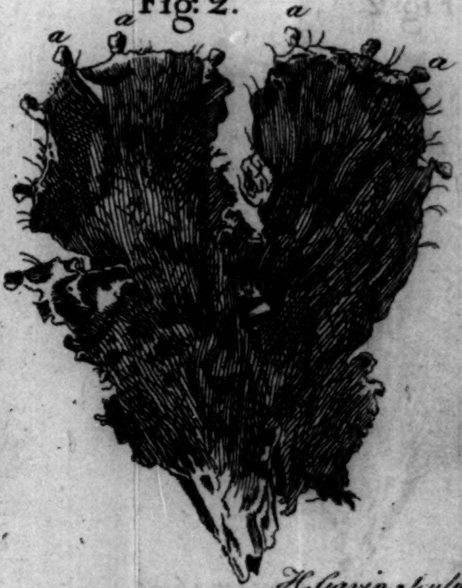


Fig: 2.



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A TREATISE concerning the INFLUENCE of the SUN and MOON upon HUMAN BODIES, and the DISEASES thereby produced.

ADVERTISEMENT.

HAving reſolved, at the inſtance of ſome friends, to give a ſecond edition of this ſmall treatiſe, I thought it incumbent on me, to read it over attentively; in order to make ſuch additions and improvements, as above forty years experience might have ſuggeſted to me ſince its firſt publication. Accordingly, in this review, I have explained ſome mathematical matters in a clearer manner than I had formerly done; and I have illuſtrated and confirmed the medicinal part by ſeveral additional obſervations and caſes, which may prove uſeful in the practice of phyſic. And indeed, that a due conſideration of this ſubject is extenſively uſeful to a phyſician, will appear with ſufficient evidence, from the various kinds of diſeaſes, the courſes and returns of which I have herein ſhewn to depend on the different poſitions and revolutions of the ſun and moon. Now, though a previous acquaintance with the mathematical principles of natural philoſophy be requiſite for comprehending this ſubject in its full extent; yet as thoſe who are little affected by geometrical demonſtrations, may poſſibly be convinced by a number of facts, I ſhall not, with reſpect to this little work, inſiſt on that ſaying of Plato :

ΟΥΔΕΙΣ ΑΓΕΩΜΕΤΡΗΤΟΣ ΕΙΣΙΤΩ.

Let none unſkilled in geometry enter here.

London, July 1. 1746.

PREFACE.

AS the ſtudy of phyſic has in all ages undergone various changes, according to the different opinions of philoſophers ; I have often wondered, how it comes to paſs, that, notwithſtanding the conſiderable advances made in the ſtudy of nature by the moderns, eſpecially in the laſt century, this uſeful art has not received thoſe benefits, which might reaſonably be expected from a ſurer method of reaſoning, than men were formerly acquainted with. That ſome of the moderns, particularly Galilei, Kepler, Torricelli, and Sir Iſaac Newton, have made vaſt improvements in natural philoſophy, by joining mathematical reaſonings to their inquiries into nature, is well known to the learned world : and yet medicine ſtill deals ſo much in conjecture, that it hardly deſerves the name of a ſcience. Whether this be owing to the nature of the art, as being incapable of ſure principles ; or rather, to the artiſts, who having got into a wrong track, will not take the pains to return into the right road ; may poſſibly be a matter of inquiry on ſome other occaſion. In the mean time, in order to prove how beneficial the ſtudy of geometry muſt be to phyſicians, as well for inveſtigating the cauſes of diſeaſes, as for finding proper remedies for them; I have attempted to explain a very difficult queſtion, concerning the courſes and returns of ſome diſtempers; the nature of which is ſuch, that it cannot be thoroughly well handled by any other means.

Thus I am neceſſitated, in this diſquiſition, to enter into a few more minute calculations, than a medical ſubject might ſeem to require. Wherefore the reader ought to have ſome knowledge of Sir Iſaac Newton's philoſophy; or, at leaſt, underſtand the learned and ſagacious Dr Halley's theory of the tides, upon the principles of that great philoſopher, as publiſhed in the Philoſophical Tranſactions. And thoſe who have no taſte for mathematical ſtudies, may, if they pleaſe, paſs over this part of the work. For my part, I never expect to acquire reputation by algebraical calculations, thoroughly ſenſible of the mediocrity of my genius in that branch of learning. But I flatter myſelf, that theſe ſheets will be found to contain ſome hiſtories and inſtructions, from which even thoſe who deſpiſe all reaſoning in phyſic, and rely on experience alone, will reap benefit in practice: which indeed is the main deſign of this little treatiſe.

The field is large, in which we run our career; nor are the innumerable evils, with which we are daily ſurrounded, to be remedied by any one method. The two great pillars of medicine are experience and reaſon; and he that has no confidence in the latter, at leaſt bids the fairer towards relieving the ſick, in proportion to his ſtock of the former. But yet the buſineſs of our profeſſion requires the joint aſſiſtance of both; becauſe a rational theory will teach a man to apply his experimental knowledge to the various caſes that occur.

For although a very few remedies, found out by chance, and confirmed by uſe, might poſſibly have been ſufficient for curing the diſorders of men in the earlieſt times, who, we are told, led ſober and active lives; yet in ſucceeding ages, when their conſtitutions had been injured by ſloth and luxury, they ſtood in need of different methods of cure: inaſmuch as it now became neceſſary to inquire, not only into the cauſe of the diſtemper, but alſo how its nature and uſual appearance had been changed in this or that individual. Hence that ſaying of Hippocrates *: The phyſician ſhould have an eye to things common and peculiar: becauſe, as Celſus rightly obſerves, there are caſes, in which the ſame diſorder puts on a different appearance from that which it uſually has; and the diſcovery of the cauſe is ſometimes the cure of the diſtemper †.

And it is probable that the only reaſon why the profeſſion of phyſic lay buried in total darkneſs for near five hundred years, that is, from the Trojan to the Peloponneſian war, as Pliny has recorded ‡, was, that, whereas new diſeaſes ſtarted up from time to time, and thoſe who had nothing but experience to make them phyſicians, were unequal to theſe new difficulties; the philoſophers ingroſſed the art, which was found to be lame and infirm without the knowledge of nature. Thus Celſus ſays of that ſpace of time, that the ſcience of phyſic was accounted a part of philoſophy; ſo that the curing of diſeaſes, and the

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* Epidem. lib. i. † In præfat. ‡ Lib. xxix. in procem.

contemplation of nature, took their riſe from the ſame perſons *.

Now, as it is of conſequence to the ſubject in hand, ſo it is eaſy to prove, that thoſe philoſophers who laid the firſt foundations of our art, were really famous geometricians. And firſt, the moſt eminent among the ſages of antiquity was Pythagoras, who had acquired ſuch high reputation for his ſkill in phyſic, that it was commonly ſaid, that he travelled, not ſo much for the ſake of inſtructing people, as of curing them †. But the progreſs made by him in mathematical ſtudies alſo was extraordinary. Witneſs his two noble diſcoveries; the one, of the ſquare deſcribed upon the ſide ſubtending the right angle in a right-angled triangle, being equal to both the ſquares deſcribed upon the ſides containing the right angle; the other, of the area of the parabola, which, according to Proclus ‡, he firſt demonſtrated. For the firſt of theſe problems, Athenæus || and Diogenes Laertius +, upon the authority of Apollodorus the arithmetician, ſay, that he offered a hecatomb in ſacrifice. But Plutarch -+, after citing a verſe of Apollodorus, leaves it doubtful for which of the two he made that offering.

Empedocles was his diſciple in Italy, a perſon of a vaſt genius, who, having penetrated into nature's inmoſt receſſes, performed ſuch great things in our profeſſion, as were not to be expected from a bare experimental knowledge of phyſic. For when his native

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* Loco citato. † Ælian. var. hiſt. lib. iv. cap. 17.

‡ Lib. iv. ad primum Euclid. || Lib. x. p. 418.

+ In vita Pythagoræ, lib. viii. ſegm. 12. -+ Quod ne vivere jucunde quiſquam poſſit, qui ſectam ſequatur Epicuri.

city Agrigentum was infected with a dreadful plague, he ſoon found out the cauſe; and thereupon by ſtopping up ſome openings in the mountains, through which unwholeſome winds iſſuing brought the contagion, he averted the evil *. He rendered the ſame ſervice to the Selinuntians: for when they were ſeized with a plague from the corruption and ſtench of the ſtagnating waters of a river, which ſurrounded the city; he ordered two neighbouring rivers to be conveyed into it: by which means, having made a current, and cleanſed the channel, the waters gradually grew ſweet, and the plague ceaſed †. Now theſe facts are the more worthy of being recorded; becauſe the ancients were generally of opinion, that peſtilence proceeded from the anger of the gods, and therefore was not to be cured by natural remedies: whereas, in both theſe caſes, the remedies were pointed out by mechanical reaſoning; and that calamities of this kind are owing to ſuch cauſes, is confirmed by a great number of obſervations publiſhed by various authors.

Democritus, who is thought by ſome to have been Hippocrates's maſter, was equally famous for geometry and phyſic. For he is ſaid to have written, among other things, Of the contact of the circle and ſphere; Of geometry; Of incommenſurable lines; as alſo, Of the nature of man; Of the humours; and, Of plagues ‡.

By thoſe great men, and others like them, was this profeſſion carried on to the time of Hippocrates;

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* Idem, de curioſitate, & lib. contra Coloten.

† Vid. Diog. Laert. lib. viii. ſegm. 70.

‡ Idem, in vita Democriti, lib. ix. ſegm. 46. & 47.

who, as Celſus ſays, was the firſt that ſeparated this art from philoſophy *. For he, plainly perceiving, that the ſuperſtition of the common people, the impudence and vain pretences of quacks, and the pride and vanity of the ſophiſts, were mighty obſtacles to the improvement of the art, propoſed to himſelf in all his writings to guard againſt thoſe impediments and difficulties. And accordingly, in his valuable book De morbo ſacro, he teaches how to obviate falſe religious notions; and is very copious in detecting the frauds and fallacies of thoſe men who covered their ignorance with a veil of piety, making profeſſion of charming away thoſe diſeaſes which they could not cure by medicines. In his books De arte, De decoro, De præceptionibus, he diſputes not only againſt thoſe who denied that phyſic was an art, and therefore had no regard to any thing but experience; but alſo againſt thoſe who practiſed upon a wrong plan. And becauſe the divine old man is made a tool by contending parties for their reſpective notions, I cannot avoid obſerving, that mechanical reaſoning is every where approved and recommended in thoſe treatiſes by that great parent of medicine. For he ſays: I praiſe reaſoning, when it is grounded on ſuch principles as fall under our ſenſes, or are proved by experiments; and draws concluſions from manifeſt premiſſes. But if it is carried on by unjuſt deductions, and is built upon fictitious opinions, it occaſions great trouble and difficulties †. And this ſentiment is illuſtrated and confirmed in his book De priſca medicina; where after ſaying, that moſt phyſicians are very like unſkilful pilots, whoſe ignorance of their art is not diſcovered,

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* In præfatione. † Lib. de præcept.

while the veſſels ſail in good weather before the wind; but if a ſtorm ariſe, then it ſoon appears, that their blunders were the cauſe of the ſhipwrecks which happen; he tells us, that our chief care ſhould be to learn the properties of things, not by imagining or contriving, but by finding out the powers which they are endowed with, and exerciſe on our bodies; in which inquiry great regard muſt be paid both to the qualities of the humours, and to the figures of the parts: ſome of which from a wide beginning run into a narrow apex, others are more and more expanded; ſome are ſmooth and cylindrical; ſome denſe or firm, others, in fine, thin and lax. This is the wiſdom which ought to accompany the ſtudy of medicine; by means of which, he ſays, the artiſt becomes equal to the gods *.

But I ſhall enlarge no farther at preſent on this theme. However, it manifeſtly appears from what has been hitherto ſaid, that Hippocrates gave the name of *Sophiſts* † to thoſe who argued on fictitious principles; and that of real phyſicians ‡ to thoſe who reaſon from the laws of nature, and a knowledge of the animal fabric. Which I obſerve for the ſake of thoſe, who, as if there was no difference between the groundleſs hypotheſes of philoſophers, and the certain concluſions of geometricians, hold this moſt uſeful ſcience in contempt, and even turn it into ridicule before the ignorant multitude. But ſurely theſe apply themſelves both to philoſophy and phyſic, without having any genius to either; for want of which they cannot diſcern the wide diſtance between ſophiſtical opinions and geometrical reaſonings. For he who

* Lib. de decoro.

† Σοφιστὰς.

‡ Ἔργῳ ἰητροὺς.

builds an hypotheſis, follows plauſibility, and thinks it ſufficient, if he can account for appearances from his principles : whereas mechanical theory deals in demonſtrations, which the able geometrician deduces either from the figures of bodies, or from the known laws of motion, by neceſſary conſequences.

Examples will ſet this matter in a clearer light. Des Cartes compiled a ſet of ſuſpicions and conjectures on the gravity of bodies, and yet made no proficiency thereby in the knowledge of nature : but Sir Iſaac Newton, by purſuing its laws in a geometrical manner, without any regard to the cauſe, laid open to our contemplation the real fabric of the world. Dr Willis invented an idea of ſoporiferous diſeaſes ; from which we learn, that the author had words at will, but knew nothing of the nature of thoſe diſeaſes : whereas Bellini, by bringing their hiſtory and ſymptoms under mechanical reaſonings, paved the way to the knowledge and cure of thoſe great evils. But enough of this ſubject.

When I had communicated my intention of publiſhing this piece to my friend the celebrated Dr Pitcairne, he not only applauded my deſign, but, of his great humanity, readily ſent me ſome hiſtories of periodical diſeaſes out of his large ſtock. Thoſe I have ranged in their proper places, as conſiderable ornaments to my little book, not without a ſenſe of pleaſure, in ſeeing my opinion confirmed by the teſtimony of ſo great a maſter in theſe ſtudies ; and the rather, becauſe it was proper to produce the obſervations of others, as well as my own, in ſupport of this new theory. And I may not conceal in this place, that our diſſertation diſplays, not a little, the wiſdom, goodneſs, and wonderful contrivance of the omnipotent Creator of the world; who, while he made ample proviſion for all living things, eſtabliſhed this difference between brutes and rational creatures; that whereas thoſe enjoy the common gifts of nature, he has permitted us, beſides, to inveſtigate their properties and uſes, and to contemplate the labyrinth of his divine works.

Laſtly, I have but lightly touched upon the cure of the caſes related in this treatiſe; becauſe I intend, whenever I find ſufficient leiſure, to publiſh the moſt remarkable obſervations, which I have already, or may hereafter make on moſt diſeaſes.

London, 1704.

A TREATISE concerning the INFLUENCE of the SUN and MOON upon HUMAN BODIES, &c.

CHAP. I.

That the ſun and moon cauſe various alterations in the human body, according to their different poſitions with reſpect to the earth.

IT was the general opinion of the ancient phyſicians, that ſome diſeaſes are entirely owing to the influence of the celeſtial bodies, and that the paroxyſms and periods of others are regulated by the action of the moon in particular: wherefore the earlieſt hiſtories of epidemics, which have been handed down to us, are full of the motions and powers of thoſe luminous orbs. Upon this principle it is, that Hippocrates adviſes his ſon Theſſalus to the ſtudy of numbers and geometry *: becauſe, ſays he, the riſing and ſetting of the ſtars have a great effect on diſtempers †.

But when in courſe of time medicine began to be accommodated to the reaſonings of philoſophers; no body being able to account for the manner of this celeſtial action, and the rule of obſervation being gradually laid aſide, it was allowed no farther ſhare in affecting our health, than what might be imputed to the changes in the manifeſt conſtitution of the air: excepting perhaps ſomething of truth, which ſtill remains diſguiſed and blended with the jargon of judicial aſtrology.

In order therefore to ſet this obſcure and difficult matter in a little clearer light, I ſhall, in the firſt place, endeavour to ſhew, that the ſun and moon, regarding their nearneſs and direction to the earth only, beſides the effects of heat, moiſture, &c. thereby cauſed in our atmoſphere, muſt at certain times make ſome alterations in animal bodies; then enumerate ſome hiſtories and obſervations of ſuch changes, and inquire of what uſe ſuch thoughts as theſe may be in the practice of phyſic.

It is a conſtant obſervation of thoſe who have written the hiſtory of the winds, that the moſt windy ſeaſons of the year are the times about the vernal and autumnal equinox. Every body likewiſe knows, that in the moſt quiet weather there is generally ſome breeze at mid-day, and midnight, as alſo at full ſea;

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* Epiſt. ad Theſſalum. † De aëre, aquis, et locis.

that is, always about the time when the ſun or moon arrives at the meridian, either over or under our hemiſphere. Seamen and country-people reckon upon this, and order their affairs accordingly. And the changes of the weather, as to winds or calms, eſpecially about the new and full moon, are too well known to require any authority to confirm ſuch remarks. Thoſe who deſire a fuller account of theſe obſervations, may ſee it in J. Goad's Aſtrometeorologia *. Theſe things being matters of fact, and in a manner regular and univerſal, it may very well ſeem ſtrange, that philoſophers have not been more accurate in their inquiries into the reaſon of ſuch appearances. True indeed it is, that the origin of winds is various and uncertain; but however, ſo conſtant and uniform an effect muſt undoubtedly be owing to one neceſſary cauſe.

It has been, now a conſiderable time ſince, ſufficiently made out, that our atmoſphere is a thin elaſtic fluid, one part of which gravitates upon another, and whoſe preſſure is communicated every way in a ſphere to any given part thereof. From hence it follows, that if by any external cauſe the gravity of any one part ſhould be diminiſhed, the more heavy air would ruſh in from all ſides around this part, to reſtore the equilibrium, which muſt of neceſſity be preſerved in all fluids. Now, this violent running in of the heavier air would certainly produce a wind, which is no more than a ſtrong motion of the air in ſome determined direction. If therefore we can find any general cauſe, that would, at theſe ſtated ſeaſons, which we have mentioned, diminiſh the weight or preſſure of the atmoſphere; we ſhall have the genuine

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* London, 1690. 4°.

reaſon of theſe periodical winds, and the neceſſary conſequences thereof.

The flux and reflux of the ſea was a phænomenon too viſible, too regular, and too much conducing to the ſubſiſtence of mankind, and all other animals, to be neglected by thoſe who applied themſelves to the ſtudy of nature: however, all their attempts to explain this admirable contrivance of infinite wiſdom were unſucceſsful, till Sir Iſaac Newton revealed to the world juſter principles; and, by a truer philoſophy than was formerly known, ſhewed us how, by the united or divided forces of the ſun and moon, which are increaſed and leſſened by ſeveral circumſtances, all the varieties of the tides are to be accounted for. And ſince all the changes we have enumerated in the atmoſpere, do fall out at the ſame times when thoſe happen in the ocean; and likewiſe whereas both the waters of the ſea, and the air of our earth, are fluids ſubject, in a great meaſure, to the ſame laws of motion; it is plain, that the rule of our great philoſopher takes place here, viz. that natural effects of the ſame kind are to be attributed, as much as poſſible, to the ſame cauſes *.

What difference that known property of the air, which is not in water, makes in the caſe, I ſhall ſhew anon. Setting aſide the conſideration of that for the preſent, it is certain, that as the ſea is, ſo muſt our air, twice every twenty-five hours, be raiſed upwards, to a conſiderable height, by the attraction of the moon coming to the meridian; ſo that inſtead of a ſpherical, it muſt form itſelf into a ſpheroidal figure, whoſe longeſt diameter, being produced, would paſs through the moon. That the like raiſing

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* Newton princip. pag. 387.

muſt follow, as ſoon as the ſun is in the meridian of any place, either above or below the horizon ; and that the moon's power of producing this effect exceeds that of the ſun, in the proportion of 4 $\frac{1}{2}$ to 1 nearly. Moreover, that this elevation is greateſt upon the new and full moons, becauſe both ſun and moon do then conſpire in their attraction ; leaſt on the quarters, in that they then drawing different ways, it is only the difference of their actions that produces the effect ; laſtly, that this intumeſcence will be of a middle degree, at the time between the quarters, and new and full moon. The different diſtances of the moon in her perigæum and apogæum, likewiſe increaſe or diminiſh this power. Beſides, the ſun's leſſer diſtance from the earth in winter is the reaſon, that the greateſt and leaſt attraction of the air upwards more frequently happens a little before the vernal, and after the autumnal equinox. And in places where the moon declines from the equator, the attraction is greater and leſſer alternately, on account of the diurnal rotation of the earth on its axis.

Whatever has been ſaid on this head, is no more than applying, what Sir Iſaac Newton has demonſtrated of the ſea, to our atmoſphere : and it is needleſs to ſhew, how neceſſarily thoſe appearances, juſt now mentioned of winds, at the ſtated times, muſt happen hereupon. It will be of more uſe to conſider the proportion of the forces of the two luminaries upon the air, to that which they have upon the waters of our globe ; that it may the more plainly appear, what influence the alterations hereby made muſt have upon the animal body.

Sir Iſaac Newton has demonſtrated *, that the force of the ſun to move the ſea, is to the force of gravity, as 1 to 12868200. Let this be

$$S : G :: 1 : n. \text{ Hence, } S = \frac{G}{n}.$$

And that the force of the moon to raiſe the ſea is to gravity, as 1 to 2871400. Let this be

$$L : G :: 1 : s. \text{ Hence, } L = \frac{G}{s}.$$

And ſince the centrifugal force of the parts of the earth, ariſing from its diurnal motion, is to gravity, as 1 to 289; let this be

$$C : G :: 1 : e. \text{ Then } C = \frac{G}{e}.$$

Hence,

$$S + L : C :: \frac{G}{n} + \frac{G}{s} : \frac{G}{e} :: \frac{1}{n} + \frac{1}{s} : \frac{1}{e} :: 1 : \frac{sn}{s+n\times e} :: 1 : 8123.$$

The ſame philoſopher has taught us, that the centrifugal force raiſes the water at the equator above the water at the poles, to the height of 85472 feet †. Wherefore if that force, which is as 8123, raiſes the ocean to 85472 feet; the united forces of the ſun and moon, which are as 1, will raiſe the ſame to 10 $\frac{1}{2}$ feet:

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* Princip. lib. iii. prop. 36. & 37. † Ibid. lib. iii. prop. 37.

for

$$\text{for } \frac{85472}{8123} = 10\tfrac{1}{2} \text{ nearly.}$$

Now, we know that the more eaſily the water can obey the attraction, with the more force are the tides moved: but ſince, as the ſagacious Dr Halley has determined it, our atmoſphere is extended to forty-four miles, whereas the middle depth of the ocean is but about half a mile; it is plain, that the air, revolving in a ſphere about a hundred times larger than that of the ocean, even ſuppoſing the whole terreſtrial globe covered with water, will have a proportionably greater agitation. Beſides, rocks, ſhelves, and the inequality of ſhores are a great ſtop to the acceſs and receſs of the ſea: but nothing repels the riſing air, which is alſo of ſuch thinneſs and fluidity, that it is eaſily driven, and runs every way.

Nor ought we to omit, that it is the univerſal law of bodies attracted, that the force of attraction is reciprocally as the ſquares of their diſtances; ſo that the action of the ſun and moon will be greater upon the air, than upon the water, upon the account of its nearneſs. But the conſideration of the elaſticity is ſtill of greater moment here; of which this is the nature, that it is reciprocally as the preſſure: ſo that the incumbent weight being diminiſhed by the attraction, the air underneath will upon this ſcore be mightily expanded. True it is indeed, that this preſſure diminiſhes gradually, in ſuch ſort, that it is of no moment beyond a certain diſtance from the earth: but yet a ſmall alteration therein produces a very conſiderable effect; becauſe thereby our ambient air the more readily yields to the attractive faculty.

Theſe and ſuch like cauſes will make the tides in the air from the moon's attraction, to be much greater than thoſe of the ocean. Nor is it neceſſary to our purpoſe to determine, by nice calculations, their particular forces: it is ſufficient to have proved, that theſe motions muſt both be univerſal, and alſo return at certain intervals.

Now, ſince the raiſing of the water of the ocean to ten feet and a half, produces torrents of ſuch a prodigious force; we may eaſily conceive what tempeſts of winds, if not otherwiſe checked, the elevation of the air much higher, perhaps above a mile, will neceſſarily cauſe. And there is no doubt to be made, but that the ſame infinitely wiſe being, who contrived the flux and reflux of the ſea, to ſecure that vaſt collection of waters from ſtagnation and corruption, which would inevitably deſtroy all the animals and vegetables on this globe; has ordered this ebb and flood of the air of our atmoſphere, with the like good deſign; that is, to preſerve the ſweet freſhneſs, and briſk temper of this fluid, ſo neceſſary to life; and keep it, by a kind of continual circulation, from deadneſs and ſtinking. We daily feel the benefits of this wonderful contrivance; but I cannot find, that the manner of it has been hitherto accounted for. And yet no ſubject better deſerved the ſerious conſideration of phyſicians: ſince it has been obſerved, that people recover ſpeedily from waſting chronical diſeaſes in clear open air; and that the beſt conſtitutions are very liable to ſickneſs in moiſt cloſe places.

This reaſoning is liable to only one objection, That I know of, which is this: that the appearances we have mentioned, cannot be owing to the cauſes now aſſigned;

aſſigned ; ſince, by calculation from them, the mercury muſt at new and full moon ſubſide in the barometer to a certain degree ; which yet barometrical writers do not obſerve to happen. Ramazzini in particular expreſſes his ſurpriſe on this head, thinking it reaſonable to ſuppoſe, that as the tides in the ocean are obſerved to be greater at thoſe times, than at any other time of the moon, on account of the influence which this planet is thought to have on the ſea ; ſo likewiſe ſome remarkable change ought to appear in the gravity of the atmoſphere. But yet, ſays he, nothing of this kind has happened, worth mentioning ; for through the whole courſe of this year there was little or no difference in the height of the mercury at the new and full moons, with reſpect to the preceding and ſubſequent days ; nor indeed during all the times of its darkneſs *.

In anſwer to which, it may not be amiſs to inquire into the cauſe of the riſe and fall of the quickſilver in the barometer, which does not ſeem to have been cleared up by writers on this ſubject. Firſt, then, it is certain, that this heavy fluid is raiſed by the preſſure of the incumbent air, and that the preſſure of this element is in proportion to its gravity : which as it is the greater, the more air is contained in the column directly impending on the quickſilver ; whatſoever increaſes or diminiſhes this quantity of air will make the quickſilver riſe or fall in the tube. Hence it is, that winds occaſion very conſiderable changes in the weather-glaſs ; according as they rareſy or condenſe the air in this column. Thus between the tropics, where the trade-winds reign, which are moderate

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* Ephemerid. baromet. Mutinenſ. an. 1694. p. 19.

derate gales, conſtantly blowing from the ſame quarter for ſeveral months together, the variations of the barometer are very inconſiderable, as Dr Halley has obſerved *; whereas in northern latitudes they are conſiderable, and indeed more ſo than in ſouthern latitudes: becauſe ſtorms are more common in the former, than in the latter; and at thoſe times which are moſt ſubject to winds, the mercury varies almoſt every hour: as Ramazzini has obſerved about the equinoxes. For about theſe, he ſays, I have obſerved remarkable variations, and eſpecially at the autumnal equinox, when the quickſilver roſe and fell ſeveral lines in one day; whereas in the ſolſtices it kept the ſame ſtation as in the foregoing days †. But yet, let the air be raiſed ever ſo high at the new and full moon, it cannot poſſibly happen, that the mercury ſhould conſtantly ſubſide in all places at thoſe times: becauſe ſuch is the known property of winds, that thoſe which carry off and rarefy the air in one place, croud it in, and condenſe it in another.

This matter thus far explained, it will not be improper to ſubjoin the ſolution of a difficult queſtion, which has raiſed great contention among philoſophers; viz. whereas water is more than eight hundred times heavier than air, how does it happen, that the latter, when replete with watery vapours, depreſſes the mercury in the barometer, ſo that its fall is an indication of rain? Now, this phænomenon ſeems to me to be chiefly owing to the following cauſes. Water is ſo entirely void of elaſticity, that no force can compreſs it into a narrower compaſs; and at the ſame time, a boiling heat divides it into ſuch minute particles, as

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* Phil. Tranſ. N° 181. p. 111. † Lib. citat. p. 20.

to make it occupy fourteen thouſand times more ſpace, than it naturally takes up *. This vapour, more than ſixteen times thinner than our air, is ſo ſubtile, that it is eaſily retained by the particles of the air, and unites with them, much in the ſame manner, as the very ſmall parts of metals, diſſolved in ſome acid liquors, are ſuſpended by them. For it is well known, that the more minutely bodies are divided, the more ſurface they acquire in reſpect to their bulk. Beſides, the air, which we breathe, contains a vaſt number of particles heavier than water, I mean the exhalations from minerals, animals, and vegetables, and, in a word, from all the productions of the earth. But perhaps what is of greateſt moment in this caſe, is the quality of the particles exhaled from the earth, which are chiefly ſulphureous. For it has been found by experiments, that the fumes from ſulphur are ſo contrary to elaſticity, that they quite deſtroy it †. Now, Sir Iſaac Newton has ſhewn, that almoſt all bodies contain ſulphur: and the phænomena of lightning and thunder ſhew, that the atmoſphere is full of it. Wherefore theſe reaſons ſufficiently prove, that moiſt air has leſs power to act than dry air. When theſe very ſubtile watery vapours, by their attractive and repulſive qualities, have run into one another, and formed drops; they thereby become heavier than air, and fall to the earth in the form of rain: and then the air, freed from theſe vapours, acts with greater force, and raiſes the mercury in the barometer.

But to return: The winds are produced by ſo

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* See Deſaguliers's courſe of experimental philoſophy, vol. ii. lect. x.

† See Hales's ſtatical eſſays, vol. i. p. 230. and 299.

many different cauſes, that a perſon would find himſelf greatly miſtaken, who would attempt to account for them all upon any one principle.

Wherefore to thoſe already explained, we may add that conſtant cauſe of the motion of the air, I mean the heat of the ſun. For as Dr Halley * has demonſtrated, that the trade-winds, which reign between the tropics, owe their riſe to it; ſo it is moſt certain, that it may occaſion various motions of the air in every part of the terraqueous globe. Moreover, we know that there ſometimes happen violent tempeſts in the upper regions of the air, while we enjoy a calm below; and that the ridges of mountains check the propagation of the winds in many places: ſo that it is no wonder, that the phænomena of the changes of the air, which we have aſcribed to the action of the moon, are not always conſtant and uniform. Now, the chief cauſes of uncertain and irregular winds are theſe. Firſt, elaſtic vapours forced from the bowels of the earth, by ſubterraneous heats, and condenſed by what cauſe ſoever in the atmoſphere. Secondly, a mixture of effluvia of different qualities in the air, may, by rarefactions and fermentations, produce winds, and other effects, like thoſe reſulting from the combination of ſome chemical liquors. And that ſuch things happen, we are aſſured from the nature of thunder, lightning, and meteors. Thirdly, from the eruptions of volcano's, and earthquakes in diſtant places, winds may be propagated to remoter countries. Laſtly, the divided or united forces of the other planets, and of

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* Phil. Tranſact. N° 183.

comets, may variouſly diſturb the action of the ſun and moon.

Theſe things being premiſed, it will not be difficult to ſhew, that theſe changes in our atmoſphere at high water, new and full moon, the equinoxes, &c. muſt occaſion ſome alterations in all animal bodies; and that from the following conſiderations.

Firſt, all living creatures require air of a determined gravity, to perform reſpiration eaſily, and with advantage: for it is by its weight chiefly, that this fluid inſinuates itſelf into the lungs Now, the gravity, as we have proved, being leſſened at theſe ſeaſons, a ſmaller quantity than uſual will inſinuate itſelf; and this muſt be of ſmaller force to comminute the blood, and forward its paſſage into the left ventricle of the heart: whence a ſlower circulation enſues, and the ſecretion of the nervous fluid is diminiſhed.

Secondly, this effect will be the more ſure, in that the elaſticity of the atmoſphere is likewiſe diminiſhed. Air proper for reſpiration muſt be, not only heavy, but alſo elaſtic, to a certain degree: for as this is by its weight forced into the cavity of the thorax in inſpiration, ſo the muſcles of the thorax and abdomen preſs it into the moſt minute ramifications of the bronchia in expiration; where the bending force being ſomewhat taken off, and ſpringy bodies, when unbended, exerting their power every way, in proportion to their preſſures; the parts of the air puſh againſt all the ſides of the veſiculæ, and promote the paſſage of the blood. Therefore the ſame things which cauſe any alterations in this property of the air, will more or leſs diſturb the animal motions. We have a convincing inſtance of all this, in thoſe who go to the top of high mountains: for the air is there ſo pure (as they call it), that is, thin, and wants ſo much of its gravity and elaſticity, that they cannot take in a ſufficient quantity of it to inflate the lungs, and therefore breathe with very great difficulty.

Laſtly, all the fluids in animals have in them a mixture of elaſtic aura, which, when ſet at liberty, ſhews its energy, and cauſes thoſe inteſtine motions we obſerve in the blood and ſpirits; the exceſs of which is checked by the external ambient air, while thoſe juices are contained in their proper veſſels. Now, when the preſſure of the atmoſphere upon the ſurface of our body is diminiſhed, the inward air in the veſſels muſt neceſſarily be enabled to exert its force, in proportion to the leſſening of the gravity and elaſticity of the outward: hereupon the juices begin to ferment, change the union and coheſion of their parts, and ſtretch the veſſels to ſuch a degree, as ſometimes to burſt the ſmalleſt of them. This is very plain in living creatures put into the receiver, exhauſted by the air-pump; which always firſt pant for breath, and then ſwell, as the air is more and more drawn out: their lungs at the ſame time contracting themſelves, and falling ſo together, as to be hardly diſcernible, eſpecially in the leſſer animals *.

Concerning the weight of the atmoſphere on a human body, and its difference of preſſure at different times, let this eſtimate ſuffice. We will lay it down as certain, that this weight and preſſure may be computed from the force with which the air raiſes the

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* Eſperienze dell' academia del cimento, p. 118.

quickſilver in the barometer. The ſurface of a man's body, of a middle ſize, is fifteen ſquare feet, or 2160 inches. The weight of a cubic inch of quickſilver is 8, 101, &c. ounces Avoirdupois. Wherefore the preſſure of the air on every ſquare inch of the human body, in the ratio of the weight of the quickſilver in the barometer, will ſtand thus. A column of quickſilver, an inch ſquare, can in England be raiſed in the barometer to 30 inches and $\frac{8}{10}$, by the air when heavieſt; and it will ſubſide to 28 inches, when the air is lighteſt. Conſequently, the air, when heavieſt, will preſs on every inch of the ſurface of the human body, with the weight of 15 pounds and 9 ounces; when lighteſt, with that of 14 pounds 2 ounces Avoirdupois. Thus the whole body, in the heavieſt air, ſuſtains a weight of about 33684 pounds; in the lighteſt, of 30622 pounds 5 ounces. Whence the difference of preſſure at different times is 3062 pounds nearly. True it is, that the internal air of the human body makes a reſiſtance to that weight: but yet ſuch change of preſſure muſt neceſſarily have conſiderable effects; eſpecially when this internal air, through ſome defect in the animal fluids, with which it is mixed, is increaſed or diminiſhed in its natural properties.

Before we proceed to other matters, it may be worth the while to take notice of two things: firſt, that effects depending on ſuch cauſes as theſe, muſt of neceſſity be moſt viſible in weak bodies, and morbid conſtitutions, when other circumſtances concur to their taking place; while ſtrong bodies and ſound conſtitutions are little affected by them. For this reaſon, whatever miſchiefs do hence follow, cannot in the leaſt diſparage the wiſe contrivance of infinite power, in ordering theſe tides of our atmoſphere. The author of nature has certainly made all things to the greateſt advantage that could be, for the whole ſyſtem of animals on our globe, although ſuch a diſpoſition might in ſome caſes prove prejudicial to a few. The poſition and diſtance of the ſun are ſo adjuſted, as to give, in the moſt beneficial manner poſſible, heat and light to the earth: yet this, notwithſtanding the exceſſive ſummer-heats in ſome countries, may be attended with bad conſequences; in others, the winter-colds may be ſo intenſe, that tender bodies cannot bear them; and in all ſeaſons and climates, changes of weather may give birth to diſeaſes. The whole, however, we muſt own, is moſt carefully provided for. Beſides, as moſt of theſe laſt mentioned inconveniencies are by eaſy ſhifts to be avoided; ſo there are ſuch powerful checks put to this aereal flux and reflux, ſo many ways of abating the damages accruing from it now and then; that theſe are of no account in compariſon of the mighty benefits hence ariſing, in which the race of mankind does univerſally ſhare.

Secondly, that the other planets have likewiſe their peculiar influences; which, though inferior to thoſe of the ſun and moon, yet contribute various ways towards increaſing or diminiſhing the action of theſe on human bodies. And theſe united forces are of ſuch conſequence, that violent and occult diſeaſes, with which whole nations are ſeized, may be certainly attributed to them. And the θεῖον τι, or ſomewhat divine of Hippocrates *, which he recommends to have regard to in diſeaſes, is moſt probably nothing

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* Prognoſtic. 1.

more than the ſtate of our atmoſphere, occaſioned by the influence of the planets, or ſome other uncommon and unknown natural cauſe; as I have more amply explained on another occaſion *.

CHAP. II.

Of the diſeaſes, and ſymptoms, which derive their origin from the above-mentioned cauſes.

I Now proceed to examine what particular functions of animal bodies are diſturbed by theſe periodical rarefactions of the fluids in their proper veſſels: and here I ſhall not ground my opinion on my own obſervation alone, but likewiſe take in the aſſiſtance of other medical writers. For there are no hiſtories in phyſic, which we may more ſafely take upon the credit of the authors who relate them, than ſuch as we are now going to mention. In ſome caſes a point may perhaps be ſtrained, to ſerve a darling hypotheſis which the writer has taken up; but here we are much more likely to have pure matter of fact: becauſe hitherto no one has pretended, that the appearances of this kind are within the reach of any ſcheme of philoſophy.

And firſt it appears evident to me, that the moon's influence is neceſſarily greater on the nervous fluid or animal ſpirits, than on the blood, or any other fluid of the animal body. For as that fluid is compoſed of extremely minute, and (as I have ſhewn elſewhere †) elaſtic parts; it muſt be the more eaſily ſuſceptible of the power of any external cauſe whatever. Wherefore the moon's action will chiefly regard thoſe diſeaſes which are occaſioned by the vitiation of thoſe ſpirits.

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* See account of poiſons, eſſay vi. † See introduction to a mechanical account of poiſons.

Of this claſs none ſeem more remarkable than epileptic diſeaſes, which, beſides the other difficulties with which they are attended, have this alſo ſurpriſing, that in ſome the fits do conſtantly return every new and full moon. The moon, ſays Galen [*], governs the periods of epileptic caſes. Upon this ſcore, they who were thus affected, were by the Greek writers ſometimes called Σεληνιακοὶ [†], and in the hiſtories of the goſpel Σεληνιαζόμενοι [‡], and by ſome of the Latins afterwards, *Lunatici* [‖].

And indeed, I myſelf remember, when I was phyſician to St Thomas's hoſpital during the time of Queen Anne's wars with France, that ſeveral of the ſailors of our fleets were brought thither, and put under my care for this diſtemper: moſt of whom were new men, who had contracted the diſeaſe by frights, either in ſea-engagements, or in ſtorms. But the moon's influence was ſo viſible on the generality of them at the new and full, that I have often predicted the times of the fits with tolerable certainty. And T. Bartholin tells a ſtory of an epileptic girl, who had ſpots in her face, which varied both in colour and magnitude, according to the time of the moon. So great, ſays he, is the correſpondence between our bodies and the heavens [⸸].

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[*] De diebus criticis, lib. iii. [†] Alexand. Trallian. lib. i. c. 25. [‡] Matth. c. xvii. ver. 15. [‖] Apuleius de virtutibus herbar. cap. ix. & lxv. [⸸] Hiſtor. anatom. centur. ii. hiſt. 72.

Moreover, the learned Dr Pitcairne has aſſured me, that he attended a patient of thirty years of age, of a thin habit and ſomewhat melancholic conſtitution of body; who, nine years before, after a conſiderable hæmorrhage from the noſe, complained of ſome humour ſuddenly ariſing from his right hand to the top of his ſhoulder, and then fell ſenſeleſs on the ground. Upon his recovery from the fit, he felt ſo great a numbneſs in that hand, that he could not ſtir his fingers: and his right arm was violently toſſed forward and backward, againſt his will, for the ſpace of four minutes; during which time he loſt the uſe of his tongue. And this diſorder returned periodically twice every year, in March and September, that is, at the new moon, near the vernal and autumnal equinoxes. The moſt remarkable particulars of this caſe were theſe. Firſt, the paroxyſm came on more frequently in the night than in the day-time. Secondly, neither his feet nor left arm were ever affected by the diſorder. Thirdly, the ſtupor, which conſtantly remained ſince the firſt ſeizure of the diſorder, did never after deprive him of his ſenſes: for he could walk or ride, even when it was at the worſt. Fourthly, while the humour was moving up his hand, he could ſtill uſe his fingers: but when it had got up to the arm, then were they deprived of feeling and motion: afterwards, upon its ſeizing the right ſide of the head, it occaſioned violent convulſive motions of the arm for three or four minutes. Fifthly, at thoſe times when the fit was wont to return, he was ſometimes ſeized with the numbneſs twice or thrice in an hour; at other times not above once in two or three days. Sixthly, the diſeaſe was augmented by warm bathing:

for, after it, the paroxyſms were more violent than uſual. Laſtly, his memory was remarkably affected about the time of the paroxyſm.

The ſame gentleman informed me likewiſe, that he knew ſeveral women who were ſubject to epileptic ſymptoms at the new and full moon; eſpecially pregnant women, and thoſe who ſtopped childing early, and whoſe menſtrual purgations left them before the uſual time. Theſe were frequently ſeized by the fit in their ſleep, and ſometimes in the day-time alſo. And he remembered to have cured two young women, whoſe fits followed the change of the moon; but they were of that kind of epileptic fits, which are commonly called *St Vitus's dance.* Their geſtures were very odd and uncertain, and ſomewhat like dancing: and they were deprived of ſpeech, during the paroxyſm. In fine, other phyſicians had tried in vain to cure theſe diſorders by Sydenham's method *, for want of attending to their monthly periodical returns.

But no greater conſent in ſuch caſes was perhaps ever obſerved, than what I ſaw many years ſince in a child about five years old; in which the convulſions were ſo ſtrong and frequent, that life was almoſt deſpaired of, and by evacuations and other medicines very difficultly ſaved. The girl, who was of a luſty full habit of body, continued well for a few days; but was at full moon again ſeized with a moſt violent fit: after which, the diſeaſe kept its periods conſtant and regular with the tides. She lay always ſpeechleſs during the whole time of flood, and recovered upon the ebb. The father, who lived by the Thames ſide, and did buſineſs upon the river, obſerved theſe returns to be ſo punctual, that not only coming home, he knew how the child was before he ſaw it, but in the night has riſen to his employ; being warned by her cries, when coming out of the fit, of the turning of the water. This continued fourteen days, that is, to the next great change of the moon; and then a dry ſcab on the crown of the head (the effect of an epiſpaſtic plaſter, with which I had covered the whole occiput in the beginning of the illneſs) broke; and from the ſore, though there had been no ſenſible diſcharge this way for above a fortnight, ran a conſiderable quantity of limpid ſerum. Upon which, the fits returning no more, I took great care to promote this new evacuation by proper applications, with deſired ſucceſs, for ſome time; and when it ceaſed, beſides three or four purges with mercurius dulcis, &c. directed to be taken about the new and full of the moon, I ordered an iſſue in the neck, which being thought troubleſome, was made in the arm. The patient however grew up to woman's eſtate, without ever after feeling any attacks of thoſe frightful ſymptoms.

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* In ſchedula monitoria.

Whether or no it be through want of due heed and inquiry, that we have not, in all the collections of hiſtories and caſes, any inſtance of the like nature ſo particular as this is, I will not take upon me to aſſert: but to me it ſeems probable, that when due attention ſhall be given to theſe cauſes, various examples will occur of the ſame kind of ſympathy. In the mean time I cannot think it ſtrange, that ſome of the ancients, as Aretæus has recorded *, attributed this diſeaſe entirely to the moon; and were of opinion, that the deity of that planet inflicted this kind of puniſhment on wicked people for their crimes, and therefore called it *the ſacred diſeaſe.*

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* De diuturnis morbis, lib. i. cap. 4.

And it may not be improper to remark in this place, that the raving fits of mad people, which keep lunar periods, are generally accompanied with epileptic ſymptoms: which was atteſted to me as a conſtant obſervation by the late learned Dr Tyſon, formerly phyſician to Bethlehem hoſpital, who upon that account uſually called ſuch patients epileptic mad.

The vertigo is nearly related to the epilepſy according to Galen *, and therefore it was by the ancients called *the little epilepſy*, as Cælius Aurelianus relates †. This at leaſt is certain, that both theſe diſeaſes are frequently obſerved to obey the lunar influence: which is confirmed by ſeveral caſes that fell under the obſervation of Dr Pitcairne.

Hyſterical diſorders do likewiſe partake of the ſame nature; and therefore a juſt regard to thoſe periods will contribute to happier ſucceſs in the cure. One of Pitcairne's caſes is that of a young married woman, of a fat habit of body, and red-haired, who never had her monthly evacuations in a proper quantity. She had for four years paſt complained of a troubleſome weight or preſſure on the crown of the head, and of a cold humour at the ſame time trickling down to her ſhoulders, with great giddineſs and choking: ſhe alſo threw up a ſharp ſlimy humour from off her ſtomach, had a pain and ſqueezing about her heart, with a difficulty of breathing in the morning at upriſing; and theſe ſymptoms returned conſtantly every new and full moon.

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* In aphor. Hippoc. comment. iii. aph. 17.

† De morb. chron. lib. i. cap. 2.

Carolus Piſo, an accurate writer of medical obſervations, relates two caſes to this purpoſe; the firſt of a lady of quality, whoſe left cheek and part of the neck were wont to ſwell very ſenſibly, about the new moon; and this ſymptom was conſtantly attended with an hyſterical ſuffocation *. The ſecond was of a girl, who, about each full moon of the ſpring-ſeaſon, was ſeized with ſuch obſtinate hyſterical ſymptoms, that they continued the whole third quarter. The firſt day ſhe was convulſed, then ſhe was ſeized with a loſs of ſpeech, and fell into a deep ſleep, which laſted two days: and the remaining four days ſhe ſpent in doing inſignificant things, crying out for help, or in ſhort in a ſlight delirium, without a wink of ſleep †.

Phyſicians have recorded ſeveral remarkable inſtances of periodical palſies. The ſame Piſo gives the following. An aged man was ſeized with a ſleepineſs and great laſſitude, which was followed by a dead palſy, ſtupor, loſs of memory, and ſome degree of folly, with a fever. Theſe complaints returned regularly every new moon for two years; the ſymptoms gradually leſſening, and the laſt fits had but a faint reſemblance with thoſe he ſuffered in the beginning ‡.

Tulpius, a very candid and judicious writer, relates a ſingular caſe of a ſhaking palſy, with which a maiden of a pale complexion, and phlegmatic habit of body, was afflicted during the ſpace of three years, not conſtantly indeed, but with intermiſſions; each fit laſting near two hours, accompanied with a hoarſeneſs and ſuppreſſion of voice. The paroxyſms mani-

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* De morbis a ſeroſa colluvie, obſ. 27. † Obſ. 28.
‡ Obſ. 16.

feſtly agreed, ſometimes with the tides, ſometimes with the moon, and ſometimes with the ſun: for, according to the change of theſe, the returns were ſometimes earlier, ſometimes later *.

The ancients obſerved, and every one knows, how great a ſhare the moon has in forwarding thoſe evacuations of the weaker ſex, which have their name from the conſtant regularity they keep in their returns. And there is no queſtion to be made, but the correſpondency which we here obſerve, would be greater ſtill, and even univerſal, did not the infinite varieties in particular conſtitutions, climates, manner of life, and many accidents, one way or other concur to make a difference. It is very obſervable, that in countries neareſt to the equator, where we have proved the lunar action to be ſtrongeſt, theſe monthly ſecretions are in much greater quantity, than in thoſe near the poles, where this force is weakeſt. This Hippocrates † takes notice of, with reſpect to places far north, and gives it as one reaſon, why the women in Scythia are not very fruitful.

The caſe being thus with females, it is no wonder, if we ſometimes meet with periodical hæmorrhages anſwering to the times of the moon in males alſo. For as a greater quantity of blood, in proportion to the bulk in one ſex, is the reaſon of its diſcharging itſelf through proper ducts, at certain intervals, when the preſſure of the external air being diminiſhed, the internal aura can exert its elaſticity; ſo in the other, if at any time there happens to be a ſuperabundancy of the ſame fluid, together with a weak tone of the

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* Obſerv. med. lib. i. cap. 12.

† De aëre, aquis, & locis.

fibres; it is plain that the veſſels will be moſt eaſily burſt, when the reſiſtance of the atmoſphere is leaſt. And this more eſpecially, if any accidental hurt, or rarefying force has firſt given occaſion to the other cauſes to take effect.

I have known a young gentleman of a tender frame of body, but otherwiſe healthy, who having once, by over-reaching, ſtrained the parts about the breaſt, fell thereupon into a ſpitting of blood; which for a year and half conſtantly returned every new moon, and decreaſing gradually, continued always four or five days: the fits being more or leſs conſiderable, according as his management about that time contributed to a greater or leſſer fulneſs of the veſſels.

Doctor Pitcairne's own caſe is remarkable, both in regard to the diſeaſe and its concomitant circumſtances. In the year 1687, being at a country-ſeat near Edinburgh in February, on a fairer day than uſual at that ſeaſon, and the ſun looking reddiſh; he was ſeized, at nine in the morning, the very hour of the new moon, with a ſudden bleeding at the noſe, after an uncommon faintneſs. And the next day, on his return to town, he found that the barometer was lower at that very hour, than either he, or his friend Dr Gregory, who kept the journal of the weather, had ever obſerved it: and that another friend of his, Mr Cockburn, profeſſor of philoſophy, had died ſuddenly at the ſame hour by an eruption of blood from the lungs; and alſo five or ſix others of his patients were ſeized with different hæmorrhages.

We have two notable inſtances of the like nature in our Philoſophical Tranſactions; the one related by

Dr Muſgrave * of a perſon, who, from his infancy to the twenty-fourth year of his age, had every full moon an eruption of blood on the right ſide of the nail of his left thumb ; at firſt to three or four ounces, and after his ſixteenth year, to half a pound each time ; which when, by ſearing the part with a hot iron, it ſtopped, he fell into a ſpitting of blood, and by frequent bleeding, &c. was very difficultly ſaved from a conſumption. The other † is a ſtory of an innkeeper in Ireland, who from the forty-third year of his life, to the fifty-fifth, (in which it killed him), ſuffered a periodical evacuation at the point of the fore-finger of his right hand ; and whenever they endeavoured to ſtanch the blood, it raiſed moſt exquiſite tortures in his arm. And although the fits here kept not their returns ſo certain as in the forementioned caſe, (it may be either from the irregular way of living of the patient, or the mighty change every effuſion made in his habit of body, the quantity ſeldom amounting to leſs than four pounds at a time), yet there is this remarkable circumſtance in the relation, that the firſt appearance of this hæmorrhage was at Eaſter, that is, the next full moon after the vernal equinox : which is one of the two ſeaſons of the year, at which we have proved the attraction of the air, or diminution of its preſſure, to be greater than at any other time whatſoever.

But we are beſides this to conſider, that the ſtatic chair, and nice obſervation taught Sanctorius ‡, that men do increaſe a pound or two in their weight every month, which overplus is diſcharged at the month's end, by a criſis of copious, or thick turbid urine.

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* N° 272. † N° 171. ‡ Medic. ſtatic. ſect. 1. aph. 65.

It is not therefore at all ſtrange, that we ſhould once a-month be liable to the returns of ſuch diſtempers as depend upon a fulneſs of the veſſels; that theſe ſhould take place at thoſe times eſpecially, when the ambient air is leaſt able to repreſs the turgency; and that though new and full moon are both of equal force, yet that ſometimes one, and ſometimes the other only ſhould influence the periods, according as this or that happens to fall in with the inward repletion.

The fluor albus is a diſeaſe equally common and difficult of cure. Of this diſeaſe Dr Pitcairne has obſerved a caſe, which laſted four years; wherein the returns came regularly at every new moon, and the diſcharge conſtantly laſted eight days.

Ulcers are liable to various accidents, which render ſome of them of uncertain prognoſtic: and yet even in theſe the afflux of humours is ſometimes manifeſtly altered by this power. Baglivi * was acquainted with a learned young man at Rome, who laboured under a fiſtula in the abdomen, penetrating to the colon; which diſcharged ſo plentifully in the increaſe, and ſo ſparingly in the decreaſe of the moon, that he could make a very true judgment of the periods and quadratures of that planet, from the different quantity of the matter that came from him. This reminds me of the caſe of a young man, who after impure coition firſt felt a pain in his back, and a weakneſs and liſtleſſneſs to walk in his thighs for four days. After this, appeared an ulcer in the glans penis, which ran with fetid matter. This flux ſtopped ſpontaneouſly in about a week; but returned next new moon, and continued ſo to ſtop and return for

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* De experiment. circa ſanguin. operum pag. 449.

ſome months; till he was put into a proper courſe of medicine, whereby he was perfectly cured.

Nephritic paroxyſms have frequently been obſerved to obey the lunar attraction. Tulpius * relates the caſe of Mr Henry Ainſworth, an Engliſh miniſter at Amſterdam, who had a fit of the gravel and ſuppreſſion of urine every full moon; of which he found no relief till the moon decreaſed, unleſs by bleeding at the arm. After his death two large ſtones were taken out of his bladder, and the pelvis of the left kidney was enlarged to that degree by the quantity of urine ſo often ſtopped there, as to contain almoſt as much as the bladder itſelf. He likewiſe ſaw a caſe of a capillorum mictus, which returned periodically every fortnight, with great difficulty of urine, and ſuch uneaſineſs in the patient's body, that he could ſcarcely keep in bed †.

There is a fact almoſt contrary to theſe related by T. Bartholin; who being called to a conſultation on the caſe of M. Bullichius the chief magiſtrate of Copenhagen, found that for ſome years paſt he had been afflicted with a periodical diabetes ſpuria, which returned every month with pain after a ſevere nephritic fit, at or near the full moon; when he made twelve quarts or twenty-four pounds of water, though he had not drank a pint ‡.

I was preſent, many years ſince, at the diſſection of a child about five years old, who died of the frequent returns of nephritic fits, atttended with vomitings and a diarrhœa. The kidneys and ureters were quite ſtuffed with a ſlimy calculous matter, and it

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* Obſerv. lib. ii. c. 43. † Ibid. cap. 52. ‡ Acta medic. & philoſ. Hafnienſ. vol. i. obſ. 5.

was very inſtructive to ſee the different degrees of concretion in the ſeveral parts of it, from a clear limpid water to a milky liquor, which ſhot into branchy cryſtals, and theſe coaleſcing became a hard friable ſubſtance. Dr Groenvelt, who had attended the boy in his illneſs, obſerved him to be ſeized with his pains at every full moon for ſeveral months together, which generally ended with the voiding of a ſmall ſtone or two.

To theſe nephritic caſes I ſhall add one more, which fell under my own notice. A young lady, fourteen years of age, of a good complexion, was from her infancy afflicted with this odd diſorder. A day or two before the full moon ſhe waxed pale, weak, dejected, and melancholy; and then unwittingly diſcharged a large quantity of urine in her ſleep. And this diſcharge continued five or ſix nights together: after which it ceaſed, and then her colour and chearful temper returned. The beſt ſtrengthening medicines were of no avail, until proper evacuations were thought of and made two or three days before the return of the paroxyſm: which prevented the lunar influence.

That the fits of the aſthma are frequently periodical, and under the influence of the moon, and alſo of the weather, Van Helmont takes notice from his own experience *. And Sir John Floyer, who has given us a more particular hiſtory of this diſeaſe than any other author, obſerves, that the fits uſually return once in a fortnight, and frequently happen near the change of the moon †.

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* Aſthma & tuſſ. § 22.

† Treatiſe of the aſthma, p. 17.

A more uncommon effect of this attractive power is related by the learned Kirckringius. He knew a young gentlewoman, whoſe beauty depended upon the lunar force, inſomuch that at full moon ſhe was plump and very handſome; but in the decreaſe of the planet ſo wan and ill-favoured, that ſhe was aſhamed to go abroad; till the return of the new moon gradually gave fulneſs to her face, and attraction to her charms *. If this ſeems ſtrange, it is indeed no more than an influence of the ſame kind with that which the moon has always been obſerved to have upon ſhell-fiſh, and ſome other living creatures. For as the old Latin poet Lucilius ſays:

Luna alit oſtrea, et implet echinos, muribu' fibras
Et pecui addit —— †.

And after him Manilius;

Si ſubmerſa fretis, concharum et carcere clauſa,
Ad lunæ motum variant animalia corpus ‡.

The knowledge of criſes in acute diſeaſes is attended with great difficulties: wherefore it may be very well worth the pains to inquire, what ſhare ſuch an alteration in the weight and preſſure of the atmoſphere may have in them. The ancients made great account of critical days, and regulated their practice in fevers according to the expectation they had from them. This part of phyſic is grown now into diſuſe, quite ſlighted, and even ridiculed; and that I ſuppoſe chiefly for theſe two reaſons. For, in the firſt place, the earlieſt obſervations of this kind, which were drawn into rules, being made in hot eaſtern countries; when theſe came to be applied to the diſtempers of the colder northern regions, without allowance given for the difference of the climate, they were oftentimes found not to anſwer. And ſecondly, fevers of old were treated with few medicines, and chiefly managed by very ſlender diet: the motions of nature were carefully watched, and no violence offered to interrupt her work. The hiſtories therefore of criſes, though of great uſe and certainty under ſuch management as this, were at length unavoidably ſet aſide and loſt; when acute caſes came to be cured, according to this or that hypotheſis, not only by evacuations, but hot or cold alteratives too: there being no longer any room for thoſe laws of practice, which ſuppoſed a regular and uniform progreſs of the diſtemper.

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* Obſerv. anatomic. 92. † Apud A. Gellium, lib. xx. c. 8. ‡ Aſtronomic. lib. ii. ver. 93.

Wherefore, in order to underſtand a little, both what might induce the firſt maſters of our profeſſion to ſo nice and ſtrict an obſervance in this point; and what grounds there may be now for a more due regard to their precepts, even upon the ſcore of the lunar attraction only; I propoſe a few remarks, after having premiſed ſome things proper to be known on this ſubject.

It is moſt certain, that epidemic fevers are cauſed by ſome noxious qualities of our atmoſphere; and therefore it ſeems reaſonable to ſuppoſe, that ſuch changes as produce thoſe effects may happen in it in all ſeaſons by the influence of the moon. And this is confirmed by Ramazzini in his treatiſe of the epidemic conſtitution of the years 1692, 1693, and 1694, 1694, in the city and neighbourhood of Modena. During theſe three years a very contagious purple fever reigned. "And it was worthy of obſervation," ſays he, "that the diſeaſe raged more violently after the full moon, and eſpecially in the dark quarter; and abated upon the appearance of the new moon: as not only I, but other phyſicians here, conſtantly obſerved; and this obſervation was of great ſervice both in the prognoſtic and cure *."

It is well known, that in ſolar eclipſes the moon is in conjunction with the ſun, and in oppoſition in lunar eclipſes: wherefore there is nothing ſtrange in what this ſame author wonders at in theſe words. "What happened January 21. 1693, was very ſurpriſing. For the moon having been eclipſed that night, the greateſt part of the ſick died about the very hour of the eclipſe; and ſome were even ſtruck with ſudden death †." And the learned Ballonius relates a fact of the ſame nature, where he ſays, that ſome phyſicians having met on the caſe of a lady of quality; while they were actually in conſultation, a ſolar eclipſe was at hand. Wherefore, as they thought the patient in no imminent danger, they went out to view the eclipſe: but they were ſoon called back, upon the lady's fainting away, the very inſtant it began. And ſhe did not recover her ſenſes till the eclipſe was quite over ‡.

If phyſicians had formerly been acquainted with what I have laid down on the moon's influence, I make no doubt but a much greater number of facts of this kind would occur in the hiſtories of epidemic diſeaſes,

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* De conſtit. ann. 1692-3-4. Mutin. 1695. 4to, pag. 97.

† Ibid. p. 98.

‡ Epidem. lib. i. p. 48.

diſeaſes, than we find recorded at preſent. To thoſe already mentioned let me add one more, which is the more intereſting, upon account of the ſubject of it. It was our great genius and excellent philoſopher the Lord High Chancellor Bacon, Viſcount St Albans; who had this peculiarity in his conſtitution, that at every lunar eclipſe he ſuddenly fell into a ſwoon; though he did not ſo much as think or even know of the eclipſe; and did not recover till it was ended *.

And it is ſtill freſh in the memories of ſome, that in that memorable eclipſe of the ſun which happened April 22. 1715, and in which the total obſcuration laſted here at London three minutes and twenty three ſeconds, many ſick people found themſelves conſiderably worſe during the time: which circumſtance people generally wondered at, but I could eaſily account for. In the morning I went with Dr Halley, and other aſtronomers, to the obſervatory on the top of the royal ſociety's houſe in Crane-Court, in order to view the eclipſe, and conſider the ſtate of the weather, and changes that might probably happen in our atmoſphere; and then the ſun was very bright, and the ſky remarkably ſerene. But when the eclipſe became total, the air was ſo uncommonly cold and moiſt, that it made us ſhiver; and the face of nature appeared ſo extremely gloomy and diſmal, that the birds fluttered about in wild affright, and the cattle in the fields ſtood fixed as ſtatues, through exceſs of aſtoniſhment. Whereas, no ſooner had the ſun begun to emerge, but every creature aſſumed ſo cheerful an aſpect, that

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* See Rawley's life of the Right Honourable Francis Bacon, Lord Verulam, &c.

that I never ſaw, nor indeed do I ever expect to ſee ſo pleaſing a ſight.

But to return to the ſubject of fevers: It is evident that thoſe changes of the air which affect healthy bodies, muſt have a conſiderable effect on weak conſtitutions, and thoſe labouring under acute diſeaſes. To what has been already ſaid on this head I ſhall here add, that the plague itſelf is liable to be affected by the moon's action. For Diemerbroeck, who has given an accurate deſcription of the plague at Nimeguen in the year 1636, obſerved, that the contagion conſtantly increaſed about the new and full of the moon; and that the greateſt part of thoſe who were then ſeized, died *. Much more may be ſaid on this ſubject; but it appears too plain, to need further illuſtration: wherefore I return to the ſubject of criſes.

Firſt, all epidemic diſeaſes do in their regular courſe require a ſtated time, in which they come to their height, decline, and leave the body free. This is ſo conſtant and certain, that when a fever of any conſtitution, which is continual in one ſubject, happens, from ſome other cauſe, in another to be intermitting; the paroxyſms do always return ſo often, as all together to make up juſt as many days of illneſs, as he ſuffers, whoſe diſtemper goes on from beginning to end, without any abatement. Dr Sydenham, a ſworn enemy to all theories, learned thus much from downright obſervation; and gives this reaſon why autumnal quartans hold ſix months: becauſe by computation the fits of ſo long a time amount to 336 hours, or 14 days, the period of a continual fever

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* De peſte, p. 9.

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of the ſame ſeaſon *. So Galen takes notice, that an exquiſite tertian is terminated in ſeven paroxyſms; becauſe a true continual has its criſis in ſeven days: that is, the fever laſts as long in one, as in the other; in as much (ſays he) as a fit in an intermitting fever anſwers to a day in a continual †. Now, this ſo comes to paſs, becauſe,

Secondly, in theſe caſes there is always a fermentation in the blood, which goes not off, till the active particles are thrown out by thoſe organs of ſecretion, which, according to the laws of motion, are moſt fitted to ſeparate them.

Thirdly, as different liquors put upon a ferment, are depurated in different times; ſo the arterial fluid takes up a determined period, in which it is diſcharged of an induced efferveſcence.

Fourthly, The ſymptoms, during this ebullition, do not proceed all along in the ſame tenor; but, on ſome days particularly, they give ſuch evident marks of their good or bad quality, that the nature of the enſuing ſolution may very well be gueſſed at, and foretold by them. Things being thus, thoſe days on which the diſeaſe was ſo evidently terminated one way or other, were by the ancients called the days of criſis; and thoſe upon which the tendency of the illneſs was diſcovered by moſt viſible tokens, the indices of the critical days.

And thus far the foundation was good: but when a falſe theory happened unluckily to be joined to true obſervations, this did conſiderably puzzle the affair.

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* Method. curandi febres, Lond. 1666, 8vo, p. 100.

† Comment. in aphor. Hipp. lib. iv. aph. 59. & de criſib. lib. ii. c. 6.

Hippocrates, it is plain, knew not to what to aſcribe that remarkable regularity, with which he ſaw, that the periods of fevers were generally ended on the ſeventh, fourteenth, or one and twentieth day. The philoſophy of Pythagoras was in thoſe ages very famous, of which harmony and the myſteries of numbers made a conſiderable part; odd were accounted more powerful than even, and ſeven the moſt perfect of all. Our great phyſician eſpouſed theſe notions, and confined the ſtages of acute diſtempers to a ſeptenary progreſſion *: upon which this inconvenience followed, that when a criſis fell out on an even day, his meaſures were quite broken, and he apprehended a relapſe †; and if the fever did not terminate on the ſeventh, he waited for the fourteenth, and even for the twenty-firſt day.

But whereas the criſes of fevers were ſometimes obſerved to fall on the ſixth or eighth day of the diſeaſe, without any return; Aſclepiades rejected this whole doctrine as vain ‡: and Celſus, finding it to be too nice and ſcrupulous, obſerves, that the Pythagorean numbers led the ancients into the error ||.

Galen, being aware of this, ſucceeded much better in his reaſoning upon the matter; and very happily imputed the critical changes, not to the power of numbers, but to the influence of the moon; which, he obſerves, has a mighty action upon our earth, exceeding the other planets, not in energy, but in nearneſs ⫞. So that, according to him, the ſeptenary periods in acute diſeaſes are owing to the quarterly

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[*] De ſeptimeſtri partu.

[†] Aphor. ſect. iv. 36.

[‡] Vid. Celſum, lib. iii. c. 4.

[||] Ibid.

[⫞] De diebus decretor, lib. iii.

lunar phaſes, which are the times of the greateſt force, and which return in about ſeven days *. Hence it appears, that Galen hit upon the cauſe of the changes in the returns and periods of fevers; but did not ſo much as gueſs at the manner of its producing the effect.

The reſult of the whole affair in ſhort is this. A criſis is no more than the expulſion of the morbific matter out of the body, through ſome or other of the ſecretory organs; in order to which, it is neceſſary that this ſhould be prepared and comminuted to ſuch a degree, as is required to make it paſs into the orifices of the reſpective glands. And therefore, as the moſt perfect criſis is by ſweat, (both by reaſon that the ſubcutaneous glands do naturally diſcharge more than all the others put together; and alſo that their ducts being the ſmalleſt of any, whatſoever comes this way is certainly very well divided and broken), ſo the moſt imperfect is a hæmorrhage: becauſe this is an argument, that what offends is not fit to be caſt off in any part, and conſequently breaks the veſſels by the effervеſcence of the blood. An abſceſs in thoſe organs which ſeparate thick ſlimy juices, is of a middle nature betwixt theſe two.

Now, it is very plain, that if the time in which either the peccant humour is prepared for ſecretion, or the fermentation of the blood is come to its height, falls in with thoſe changes in the atmoſphere which diminiſh its preſſure at the new and full moon; the criſis will then be more complete and large: and alſo, that this work may be forwarded or delayed a day upon the account of ſuch an alteration in the air, the

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* Ibid.

diſtenſion of the veſſels upon which it depends, being hereby made more eaſy, and a weak habit of body in ſome caſes ſtanding in need of this outward aſſiſtance. Thus a fever, which requires about a week to its period, may ſometimes have a good criſis on the ſixth, and ſometimes not till the eighth day, as Hippocrates has obſerved.

In order therefore to make true obſervations of this kind, the time of invaſion is to be conſidered; the genuine courſe of the diſtemper muſt next be watched, which is not to be interrupted by any violent methods; the ſtrength of nature in the patient is to be attended to, and by what ſecretions the criſis is moſt likely to be performed: and it will then be found, that not only the new and full moons, but even the ſouthings, whether viſible or latent, of the planet, are here of conſiderable moment.

To conclude, this powerful action of the moon is obſerved not only by philoſophers and natural hiſtorians, but even by the common people, who have been fully perſuaded of it time out of mind. Pliny relates, that Ariſtotle laid it down as an aphoriſm, That no animal dies but in the ebb of the tide *. And that births and deaths chiefly happen about the new and full moon, is an axiom even among women. The huſbandmen likewiſe are regulated by the moon in planting and managing trees, and ſeveral other of their occupations. So great is the empire of the moon over the terraqueous globe.

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* Hiſt. nat. lib. ii. cap. 98.

CHAP.

CHAP. III.

Of the benefits accruing to the practice of phyſic from this theory.

IT is now time to inquire, what uſe may be made of theſe obſervations in practice. And firſt, they muſt be of ſervice in predicting the returns of the paroxyſms, and the iſſue of the diſeaſe; which will gain reputation to the phyſician, and give confidence to the patient. But I will endeavour to ſhew, that they will be of greater ſervice ſtill, in contributing towards the cure of diſeaſes. In order to which, I will firſt lay down ſome general remarks, and then deſcend to particulars.

It ſeems pretty evident, that all diſeaſes whoſe returns anſwer to the changes of the moon, ariſe from repletion. For as the moon's action produces its effect by diſtending the veſſels only, it is manifeſt, that plenitude alone can increaſe this diſtenſion, whether it happen by the quantity of the fluids, or their efferveſcence. And therefore all diſeaſes, which return but once or twice in a month, and are increaſed by the moon's influence, require evacuations: which muſt diminiſh at leaſt, if not cure the diſeaſe. But as regard is to be had to the nature of the diſtemper, and the time and manner of the evacuation; it is neceſſary to eſtabliſh ſome rules on each of theſe heads.

Firſt, then, we are to conſider, whether the diſeaſe lies in the blood-veſſels, or in the vitious quality of the fluids ſeparated from the blood, and conveyed to ſome principal part of the body. In the firſt caſe we ſhould lay the greateſt ſtreſs on phlebotomy; in the ſecond, on proper medicines for correcting the taint of the fluids. Beſides, as we know by experience, that evacuations are to be made by the way which nature points out, great attention muſt be given to finding out that way in every particular diſeaſe. Then the beſt time for evacuating is in moſt caſes a little before the paroxyſm or exacerbation; not only becauſe its violence is thereby obviated, but likewiſe becauſe the humours then turgid will flow out of the body with more eaſe, and in greater plenty. And in order to make this matter better underſtood, I will add ſome few practical remarks on the diſeaſes mentioned in the foregoing chapter.

The epilepſy is extremely difficult to be cured in adults, but in children it is the reverſe. And that evacuations, eſpecially by a bliſter laid to the back part of the head, are of great uſe here, is plain from a caſe above related *; which not only confirms the aſſertion of Panarolus, who ſays, that he cured a boy of ſeven years of age, who had been ſpeechleſs, ſtupid, and epileptic, by a bliſter applied to the coronal ſuture †; but proves the goodneſs of Celſus's advice, to apply cupping-glaſſes with ſcarification to the occiput; and beſides to apply the actual cautery in two places, one in the occiput, and the other lower down in the neck upon the firſt vertebra; in order to have a plentiful drain of the noxious humour ‡. For the head is the chief ſeat of diſeaſes of this kind: frequently occaſioned in children by plenitude, and the lentor of the blood, which has not been commi-

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* Pag. 187.

† Obſ. med. pentecoſt. iv. obſ. 30.

‡ Lib. iii. cap. 23.

nuted by bodily exerciſe, or the action of the lungs; and in adults by a redundancy of humours, falls, or ſudden frights. In this obſtinate diſeaſe the moſt proper medicines for correcting the juices, ſeem to be native cinnabar, and more eſpecially wild valerian root, before it has ſhot out its ſtalk; pulverized, and given frequently in a due quantity. For my part, I have ſeveral times found them both very ſucceſsful; and for the virtues of the laſt, I particularly recommend the reader to Panarolus *, and the famous botaniſt Fabius Columna †. However, it muſt not be forgot, that this diſeaſe owes its origin to ſo many different cauſes, and is bred in ſo many different conſtitutions of body, that the ſame remedy, which ſucceeds in one caſe, often fails in another: and therefore different medicines are to be tried, eſpecially on adults. And great regard muſt be had to the times in which the paroxyſms moſt uſually return, in order to effect a cure.

The vertigo is likewiſe cured by theſe ſame medicines. But the patient muſt be vomited now and then, and bliſtered on the head or neck. This is a diſeaſe of the eyes, and generally ariſes from too great tenſion of the extremities of the ſmall arteries, as Bellini has demonſtrated: wherefore it is no wonder if it ſhould follow the changes of the moon.

Hyſterical diſorders are cured much in the ſame manner. But they ſeldom require bleeding, and purging ſhould be uſed with caution. Emetics are of greater ſervice, eſpecially a little before the fit. For in the fit the beſt medicines are thoſe which repair the loſs of ſpirits, as gum ammoniac, Ruſſian caſtor, ſalt of

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* Obſ. med. pen. 1. obſ. 33. † Phytobaſ. p. 120.

amber, in pills, and the like. And in moſt of thoſe caſes, care muſt be taken to adapt the medicines to the uſual way of living of the patient, and to the affections of her mind.

The monthly returns of paralytic diſorders, which are ſometimes obſerved, are owing to the ſource of the diſeaſe, which is generally the head: in which the ſeroſities of the brain being extravaſated, attack the origin of thoſe nerves where they happen to lodge, and cauſe a palſy of this or that part. Hence it is, that this diſeaſe is very often the conſequence of an apoplexy, under the ſhape of a general palſy, or that of one ſide only. But when this diſorder is occaſioned by an external injury done to the nerves, or by internal tumours, then it obſerves no regular periods. The cure is to be begun by evacuating the redundant phlegm, which in moſt caſes is beſt done by ſtool; and then an eye muſt be had to the return of the diſtemper, not only by putting the patient into a courſe of attenuating medicines, as the horſe-radiſh root, wild valerian root, muſtard-ſeed, and ſuch like; but alſo of cold bathing, if his age and ſtrength will allow it: for this remedy is not ſo beneficial for old folks, as for young; but as it braces up the relaxed fibres, and promotes urine, it is proper for this diſeaſe in both theſe reſpects. For this reaſon the ancients, according to Cælius Aurelianus *, ordered their paralytic patients to ſwim in the ſea, or to undergo the cataractical courſe, by the fall of water from on high on the weak parts; on account of the greater weight of ſalt than freſh water, and the more intenſe cold of falling than ſtill water.

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* De morb. chronic. lib. ii. cap. 1.

St Vitus's dance is generally called a convulſive diſorder; but I look on it to be rather paralytic, and to take its riſe from a relaxation of the muſcles, which being unable to perform their functions in moving the limbs, ſhake them irregularly by jirks. And it is for the moſt part but a ſlight evil, and commonly ſeizes weak habits of body; girls more frequently than boys, and ſeldom adults. Wherefore I never found it difficult to be cured by the cold bath and chalybeate medicines.

The diſorders of the monthly evacuations of the fair ſex require our ſerious conſideration. As the exceſs of them generally proceeds from an acrimony in the blood, ſo the defect is chiefly owing to a lentor. For this flux is ſeldom ſuppreſſed for want of a ſufficient quantity of blood: ſuch wonderful art has the all-wiſe author of nature employed in making full proviſion for an evacuation, equally requiſite for the health of the individual, and the propagation of human kind. Wherefore, as in immoderate diſcharges regard ſhould be had to the times, when the effervescent humour can the more eaſily burſt through its veſſels, according to the doctrine already laid down; in order to make a revulſion at thoſe times, by drawing blood from parts the moſt diſtant from the ſeat of the diſtemper: ſo when a ſuppreſſion of the menſes requires blood-letting, Vander Linden's caution is to be obſerved, which is recommended by Etmuller *, and rationally accounted for by Dr Freind †. Moreover, as the Peruvian bark is very powerful in allaying the effervescence of the blood,

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* Tom. iii. p. 442. edit. 1736. † Emmenalog. p. 103.

whereby the veſſels are diſtended; it will be very proper to give it plentifully ſome few days before the time that too great a diſcharge is apprehended.

The ſame method is to be obſerved in all periodidical hæmorrhages, giving thoſe medicines at the ſame time, which reſtringe and brace up the fibres: of which the beſt are burnt alum, with a fourth part of ſanguis draconis, as I have found by repeated trials.

And it is worthy of remark, that ſo great is the moon's influence in caſes of this nature, that upon the ſuppreſſion of theſe evacuations from one part, the blood forces its way through ſome other part: which was the caſe of the young gentleman mentioned above *. For when his ſpitting of blood was ſtopped by the medicines juſt now recited, he was at the ſame ſtated times ſeized with a bleeding at the noſe, which gave me no apprehenſions, as the principal organ was no longer affected.

And this action of the moon extends even to thoſe quadrupeds that are menſtruated; for it has been obſerved, that they generally have thoſe evacuations about the new moon; in particular mares and monkeys, and that ſo conſtantly, that, according to the teſtimony of Horus Apollo, the Egyptians painted the Cynocephalus to repreſent the moon, upon account of a certain ſympathy, whereby the female of this animal has evacuations of blood from the uterus at the new and full moon: and they kept monkeys in their temples, in order to point out the times of the conjunction of the ſun and moon †. Wherefore the moon's influence is apparent in all animals, provided irregularities in their way of living do not prevent it.

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* Pag. 192. † Hieroglyphic. vid. Geſner. de ſimiis.

And this theory accounts for the periodical returns of the fluor albus, which are ſometimes obſerved, eſpecially if the diſcharge be from the uterine veſſels: for it iſſues ſometimes from theſe, and ſometimes from the glands of the vagina. In the firſt caſe, it ſtops upon the menſtrual purgations; in the latter, it flows with them, and continues even in pregnant women.

Running ulcers are likewiſe comprehended in this doctrine, it being no way ſurpriſing, that the forementioned cauſes ſhould increaſe the diſcharge of pus, eſpecially in thoſe parts where the lax pliant texture of the body makes little or no reſiſtance to the diſtenſion of the veſſels. Hence in ulcers of the head it has been found, that the patients are in great danger at the new and full moon.

The beſt method of treating nephritic pains, is to begin by blood-letting. And it will be of ſervice to the patient to obſerve, when the paroxyſms are wont to return, and to empty the veſſels, at the time which threatens the greateſt danger. For it is well known, that this diſeaſe is partly occaſioned by the compreſſion of the ſmall ducts of the kidneys from the fulneſs of the capillary arteries; which fulneſs is increaſed by the new and full moon. Whence I have more than once wondered, that the chief bent of the writers on this diſeaſe is, to drive down the gravel into the ureters and bladder: whereas the diſſection of dead bodies has taught me, as I have mentioned before, that the firſt rudiments of a calculus are a very limpid ſerum in the caruncles of the kidneys; and that this may harden to the conſiſtence of ſtone, will not ſeem ſtrange to thoſe who are acquainted with the attractive force of ſalts in ſolution, and with the effects of obſtructions in the capillary veſſels. And hence it is, that calomel given now and then is of greater ſervice in the beginning of this diſeaſe, than any diuretics: becauſe this medicine removes the obſtructions of the minute veſſels, and thus prevents the coheſion of ſaline particles, which is frequently the conſequence of ſuch obſtruction. Moreover, daily experience ſhews, that too free an uſe of diuretics is prejudicial in diſeaſes of the kidneys Which obſervation has not been ſufficiently attended to by ſome phyſicians, who not only patronized a certain monſtrous jumble of a medicine, till the legiſlature was wrought on to purchaſe the ſecret at an immenſe price; but ſtill go on to drench their patients with it, and thereby injure the ſtomach, kidneys, and bladder.

Aſthmatic diſorders are likewiſe heightened by the lunar action, both on account of a leſſer quantity of air taken into the lungs in each inſpiration, and of the diſtenſion of the veſſels by the rarefied blood: wherefore the returns of the fits are to be obſerved, and guarded againſt by moderate evacuations, as blood-letting, gentle vomits, laxatives, and ſometimes cathartics. But every thing that heats the blood, ſhould be carefully avoided, eſpecially about the uſual times of the paroxyſms: becauſe there is generally then a lurking fever; which ought not to be exaſperated by heating food or medicines. Upon this ſcore Hippocrates adviſes perſons labouring under difficult breathing, to abſtain from clamours and anger *. And Van Helmont obſerved, that aſthmatic paroxyſms return more frequently in ſummer than winter †. For which reaſon, the proper medicines in this diſeaſe, beſides

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* Epidem. lib. vi. ſect. 4.

† De aſthm. & tuſſi.

thoſe above mentioned, are ſuch as are cooling, and at the ſame time promote urine; as vinegar of ſquills; ſpirit of nitre; gas ſulphuris, which is water ſaturated with the fumes of ſulphur; and ſeveral others of the ſame nature, enumerated by Sir John Floyer.

To what has been ſaid above on criſes in acute diſeaſes, it may be worth while to add this one remark. Although great care ſhould be taken, not to raiſe any commotion in the humours on the coming on of a criſis; yet there are caſes, in which there is a neceſſity of making ſome evacuations: as for example, if the fever runs very high, the humours are ſo agitated, that no ſecretions can be performed. In this circumſtance phlebotomy is ſo far from obſtructing, that it promotes the criſis: in the ſame manner, as in the ſmall-pox and meaſles, before any appearance of the puſtules, when the turgeſcence of the humours is exceſſive, taking away ſome blood facilitates and haſtens the eruption.

The caſe is much the ſame with critical abſceſſes, wherein the fulneſs and feveriſh heat are ſometimes ſo great, that they require moderate evacuations, either by bleeding or purging. For it is to be obſerved, that the reaſon why the ancients condemned purging in fevers, was, that the moſt of their cathartics were very violent; as ſcammony, black hellebore, juice of ſpurge, and others of the like acrid nature: upon which account they contented themſelves with emptying the inteſtines by clyſters. But as we have always a good ſtock of gentle cathartics, we may ſafely give them at any time of the diſeaſe, without the leaſt apprehenſion of heating the body; eſpecially if nature points out this way, as ſhe frequently does.

COROLLARY.

Wherein the preceding reaſoning is confirmed by obſervations of the effects of ſtorms on the human body.

As we have endeavoured to prove in the beginning of this treatiſe, that the celeſtial motions, which occaſion certain diſtempers, and their periods or returns at ſtated times, are likewiſe able to raiſe winds; and that we feel the different effects of theſe, according as other cauſes concur to put the air into violent agitations: it may not be amiſs to give ſome few inſtances, how much this reaſoning is confirmed by facts.

On the twenty-ſixth of November, 1703, there aroſe a moſt furious ſtorm of wind a little before midnight, which laſted upwards of ſix hours. The hiſtory and whole theory of this wonderful phænomenon I ſhall not attempt to compile. This province was by the royal ſociety conferred on the learned Dr Halley, who was every way equal to the taſk. Wherefore I ſhall only touch on ſome circumſtances of it, which more immediately relate to the preſent theme.

The moon was then in her perigæum, and near the change: and it has been proved above, that both theſe circumſtances contribute towards attracting the air upwards, and raiſing winds *. Accordingly, the barometer was lower than uſual †, and the ſubſequent tides were very high. And moſt probably there was a concurrence of one or more of the other cauſes already aſſigned ‡, though it might be difficult to come at the knowledge of them: but as the ſtate of the weather in the preceding ſeaſons of the year is of eaſier, and perhaps not leſs uſeful, conſideration; I ſhall remark, that in thoſe places particularly, which felt the rage of the ſtorm, the ſummer and part of autumn were remarkably wet; and the winter was uſhered in by open warm weather; ſo that a thermometer (whoſe freezing point was about eighty-four) was very ſeldom below a hundred to the latter end of November *. Hence we may form a probable conjecture, that the atmoſphere was blended with vaſt quantities of ſaline and ſulphureous exhalations; which, by their various combinations and agitations, at length gave that deſtructive force to the motion of the air. And this conjecture is confirmed by the flaſhes or coruſcations, which were obſerved during the ſtorm; and by the ſaline particles found the next day on the leaves of vegetables, even at many miles diſtance from the ſea; where the graſs in ſome places taſted ſo ſalt, that the cattle did not care to eat it.

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* Pag. 171. 172. † Phil. Tranſ. N° 289. ‡ Pag. 179.

Inſtead of proſecuting this ſubject farther, I think it may not be amiſs to ſubjoin this remark; that as the new or full moon is capable of cauſing thoſe alterations in the human body, which we have already mentioned, even when it is not ſeconded by any other cauſe; ſo if it be accompanied with a tempeſtuous ſtate of the weather, the effects will be the more ſenſibly felt. And indeed I myſelf remember, that ſeveral perſons complained particularly of head-achs the very night of the ſtorm. But the caſe of a lady of quality of my acquaintance is very remarkable, who was ſtruck blind in an inſtant that ſame night. Her

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* Phil. Tranſ. N° 289.

blindneſs was the ἀμαύρωσις of the Greeks, or the gutta ſerena of the modern phyſicians : and as this is a diſtemper which does not ſeem to me to be ſufficiently underſtood, I will offer my thoughts on it in few words.

The cauſe of it is generally an obſtruction and ſubſequent diſtenſion of the capillary arteries of the retina, or ſome injury done to the optic nerves. In the firſt kind, which is vaſtly the more common, the ſight is darkened gradually ; in the laſt, the ſight is loſt, ſometimes ſooner, ſometimes later, according to the cauſe, and ſometimes in fine in an inſtant. For the optic nerves are injured many ways, and rendered incapable of performing their office : as by a blow, fall, fracture, or depreſſure of the ſcull they are often compreſſed ; in convulſions they are ſometimes loaded with extravaſated humours ; and not uncommonly they are ſeized with a ſudden palſy. And in the diſſection of perſons who had been long afflicted with epilepſies, I have obſerved, that the optic nerves were preſſed on by an extravaſated lymph collected juſt over the place, where after their junction they ſeparate, to run to the eyes : and in paralytic diſorders I have found the fibres in that place waſted and dry.

I could produce a number of obſervations from medical writers in confirmation of this theory : but I believe the following few may ſuffice. Felix Platerus, a phyſician of great experience, obſerved, in the diſſection of a dead body, a tumour, reſembling a gland, lying on the optic nerves, and obſtructing the paſſage of the animal ſpirits to the eye *. Guernerus Rolfincius found both the optic nerves waſted,

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* Obſervat. lib. 1.

in the body of a woman which he opened *. Johannes Scultetus † ſaw the optic nerves waſted to half their uſual ſize, in the body of a woman who had had a gutta ſerena for twenty years. And the Ephemerides naturæ curioſorum contain the unfortunate caſe of a young girl, who, from a blow on the left part of the head, was ſeized with a fever and delirium, then loſt her ſight, and died ſoon after. Upon opening the head, a great quantity of limpid ſerum was found in the ventricles of the brain, eſpecially forwards, where it entirely compreſſed the optic nerves ‡.

Now, as to the caſe of the lady ſtruck blind during the ſtorm, I think it no difficult taſk to account for that misfortune upon the foregoing principles, by ſaying, that the moon's action, vaſtly increaſed by the concurrence of the ſtorm, was capable of obſtructing the paſſage of the animal ſpirits to the optic nerves in a tender conſtitution, as effectually as if theſe nerves had been cut through; and conſequently of giving riſe to the gutta ſerena.

Concerning the uſe of this theory, I can ſafely ſay, that it has pointed out to me the true method of treating this diſtemper, which before my time was generally eſteemed incurable: and as the true knowledge of the cauſes of diſeaſes is a ſure foundation for practice, ſo I have ſucceeded in a number of trials on caſes of this kind. Wherefore when the capillary arteries are the ſeat of the diſeaſe, the proper medicines are thoſe which moſt effectually attenuate the viſcid humours, and remove the obſtruction: and ſuch are

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* Diſſert. anat. lib. iv. cap. 31. † Armament. chirurg. obſ. 36. ‡ Vid. miſcell. curioſ. anni 1686.

the chemical preparations of mercury. And theſe are to be continued a good while, and frequently even to raiſing a ſalivation, which is to be kept up twenty or thirty days.

But when the diſeaſe proceeds from a defect in the nerves, it requires a different method of cure from the preceding one; and is to be varied according to the injury which the nerves have received. But it plainly appears from what has been ſaid, that this ſpecies of the gutta ſerena is generally incurable. For who, but the almighty maker, can pretend to reſtore to the optic nerves their natural tenor, either when obſtructed, or their cavities ſtreightened by a viſcid ſluggiſh humour, or when waſted and ſhrivelled up; or to make a free paſſage for, and give a due impulſe to the animal ſpirits, when thoſe nerves are become paralytic? But if any hopes remain, while the diſeaſe is yet recent, a cauſtic is to be applied to the crown of the head, over the meeting of the coronal and ſagittal ſutures; and then the perioſteum is to be laid open, to make an outlet for the noxious humour from the brain. And this ulcer, like common iſſues, muſt be kept open with peas, and continued a long time: in the mean while the patient is to be put into a courſe of nervous cephalics, as wild valerian root, Ruſſian caſtor, gum ammoniac, aſa fœtida, volatile ſpirits and ſalts of the animal tribe, &c.

But to return to ſtorms: There happened a moſt violent one in England, on the third day of September 1658, the day of the death of Oliver Cromwell. As we have no journals of the weather for that year, that ever came to my knowledge, I can ſay nothing of the preceding ſtate of the air. But this is remarkable, that the ſtorm happened near the autumnal equinox, and about the full moon: which concurrence of cauſes is very well adapted to ſtir up great commotions in the atmoſphere. However that be, it is to be obſerved, that the diſeaſe of that great man was of that kind which we have ſhewn to be particularly under the moon's influence. For it is upon record, that he died of a fever accompanied with grief, from the unhappy ſtate of his domeſtic affairs: and it is very certain, that grief diſpoſes the animal ſpirits to be eaſily affected by cauſes of this nature.

But to come to a concluſion of this little work: It has been obſerved of thoſe countries which are ſubject to inundations, that theſe calamities generally happen at the times when the moon's action is moſt powerful: ſo that the learned Baccius * ſeems to have reaſon for his conjecture, that the chief cauſe of theſe evils is to be ſought for in exceſſive high tides, with the unhappy concurrence of the attractive faculty of this or that planet.

Such are the natural cauſes of ſtorms and hurricanes: but as to the queſtion of the divine power, whether or no the wrath of the Almighty ſends theſe calamities on mankind, contrary to the ordinary courſe of nature? I will not take upon me to determine, who have no intention to diſengage mens minds from the bands of religion. For though I am thoroughly convinced, that each part of the univerſe is conſtituted and moved by certain laws; and that the ſame diſpoſition of the fabric, which is the moſt convenient for the whole, ſometimes brings inconveniencies and even

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* Del tevere, lib. iii. p. 228.

deſtruction in ſome particular places : yet it is highly equitable, that the omnipotent Creator ſhould be allowed to have an abſolute dominion over all his works. And poſſibly it was agreeable to the divine wiſdom, to create the world in ſuch a manner, that natural cauſes ſhould now and then produce evils and inconveniencies on mankind ; whom it was neceſſary to affright with ſtorms, thunder, and other extraordinary phænomena, in order to keep them in a continual ſenſe of their duty.

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